UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

NETWORK-1 TECHNOLOGIES, INC.,

Plaintiff,

-against-

GOOGLE LLC and YOUTUBE, LLC,

Defendants.

MEMORANDUM OPINION & ORDER

14 Civ. 2396 (PGG)
14 Civ. 9558 (PGG)

PAUL G. GARDEPHE, U.S.D.J.:

Plaintiff Network-1 Technologies, Inc. alleges that Defendants Google LLC and YouTube LLC (collectively, "Defendants" or "Google") have infringed three of Plaintiff's patents in connection with Defendants' "Content ID system and its implementation . . . [on] the YouTube [web]site." (Cmplt. (Dkt. No. 2) ¶¶ 28, 34; 14 Civ. 9558 Cmplt. (Dkt. No. 1) ¶ 28)[1] Plaintiff alleges that Defendants have infringed the following patents: United States Patent No. 8,010,988 (the "'988 Patent"); U.S. Patent No. 8,205,237 (the "'237 Patent"); and U.S. Patent No. 8,904,464 (the "'464 Patent").

Pending before the Court are (1) the parties' proposed construction of claims; (2) Defendants' motion for summary judgment on grounds of non-infringement; (3) Plaintiff's cross-motion for summary judgment as to certain affirmative defenses; and (4) Plaintiff's appeal from an October 14, 2022 discovery order issued by Magistrate Judge Sarah Netburn.

For the reasons stated below, the Court concludes that the asserted claims of the '988 and '464 Patents are invalid as indefinite, and that Defendants are entitled to summary judgment on Plaintiff's infringement claim premised on the asserted claims of the '237 Patent.

[1] Unless otherwise noted, all citations refer to the docket in 14 Civ. 2396.

Plaintiff's cross-motion for summary judgment will be denied, and Plaintiff's appeal from Judge Netburn's discovery order will be denied as moot.

I. FACTS[2]

A. Plaintiff's Patents

All three patents at issue were originally issued to Dr. Ingemar Cox, a professor of computer science at University College London. These patents are now owned by Plaintiff. (See Cmplt. (Dkt. No. 2) ¶¶ 7-10)

The patents at issue "link[] traditional media to new interactive media, such as that provided over the [i]nternet," and address the "identif[ication] [of] a [media] work without the need of inserting an identification code into a [media] work." ('988 Patent (Dkt. No. 148-4) col. 1, 4); '237 Patent (Dkt. No. 148-5) col. 1, 4 (same); '464 Patent (Dkt. No. 148-6) col. 1, 4 (same))[3] "[E]mbodiments consistent with the [patents at issue] provide a computer-implemented method, apparatus, or computer-executable programs for linking a media work to an action. Such embodiments might (a) extract features from the media work, (b) determine an identification of the media work based on the features extracted using a sub-linear time search, such as an approximate nearest neighbor search for example, and (c) determine an action based

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[2] To the extent that this Court relies on facts drawn from a party's Local Rule 56.1 statement, it has done so because the opposing party has either not disputed those facts or has not done so with citations to admissible evidence. See Giannullo v. City of New York, 322 F.3d 139, 140 (2d Cir. 2003) ("If the opposing party . . . fails to controvert a fact so set forth in the moving party's Rule 56.1 statement, that fact will be deemed admitted." (citations omitted)). Where the non-moving party disputes the moving party's characterization of cited evidence, and has presented an evidentiary basis for doing so, the Court relies on the non-moving party's characterization of the evidence. See Cifra v. Gen. Elec. Co., 252 F.3d 205, 216 (2d Cir. 2001)

[3] Except as to deposition transcripts and patents, the page numbers of documents referenced in this Order correspond to the page numbers designated by this District's Electronic Case Files ("ECF") system. With respect to deposition transcripts, the Court cites to the page numbers originally assigned by the court reporter. With respect to patents, the Court cites to the internal sheet, figure, and column numbers.

on the identification of the media work determined." ('237 Patent (Dkt. No. 148-5) col. 4; '464 Patent (Dkt. No. 148-6) col. 4 (same); '988 Patent (Dkt. No. 148-4) col. 4 (same))

Claim 15 of the '988 Patent concerns:

> A method for associating an electronic work with an action, the electronic work comprising at least one of audio and video, the method comprising:
>
> a) electronically extracting features from the electronic work;
>
> b) electronically determining an identification of the electronic work based on the extracted features, wherein the identification is based on a non-exhaustive search identifying a neighbor;
>
> c) electronically determining an action based on the identification of the electronic work; and
>
> d) electronically performing the action.

('988 Patent (Dkt. No. 148-4) col. 25-26)

Claim 17 of the '988 Patent concerns "[t]he method of claim **15**, wherein the non-exhaustive search is sublinear." (Id. at col. 26 (emphasis in original))

Claim 33 of the '237 Patent concerns:

> A computer-implemented method comprising:
>
> a) obtaining, by a computer system including at least one computer, media work extracted features that were extracted from a media work, the media work uploaded from a client device;
>
> b) determining, by the computer system, an identification of the media work using the media work extracted features to perform a sublinear approximate nearest neighbor search of reference extracted features of reference identified media works; and
>
> c) determining, by the computer system, an action based on the determined identification of the media work.

('237 Patent (Dkt. No. 148-5) col. 28)

Claim 34 of the '237 Patent concerns "[t]he method of claim **33**, wherein the action comprises providing to and/or displaying, at another client device, additional information in association with the media work." (Id. (emphasis in original))

Claim 35 of the '237 Patent concerns "[t]he method of claim **34** wherein the additional information is an advertisement." (Id. (emphasis in original))

Claim 1 of the '464 Patent concerns:

> A method comprising:
>
> receiving, by a computer system including at least one computer, a first electronic media work;
>
> correlating, by the computer system using a non-exhaustive, near neighbor search, the first electronic media work with an electronic media work identifier;
>
> storing, by the computer system, correlation information associating the first electronic media work and the electronic media work identifier;
>
> accessing, by the computer system, associated information related to an action to be performed in association with one or more electronic media works corresponding to the electronic media work identifier;
>
> generating, by the computer system, a tag associated with the first electronic media work;
>
> providing, from the computer system to a user electronic device, the first electronic media work and the associated tag;
>
> obtaining, by the computer system from the user electronic device, a request related to the associated tag;
>
> generating, using the computer system, machine-readable instructions based upon the associated information to be used in performing, at the user electronic device, the action; and
>
> providing, from the computer system to the user electronic device, the machine-readable instructions to perform the action in response to the request.

('464 Patent (Dkt. No. 148-5) col. 24-25)

Claim 8 of the '464 Patent concerns "[t]he method of claim **1**, wherein the first electronic media work is received from a first electronic device, the associated information is received from a second electronic device, and the first electronic device, the second electronic device, and the user electronic device are different from one another." (Id. at col. 25 (emphasis in original))

Claim 10 of the '464 Patent concerns "[t]he method of claim **1**, wherein the associated information is related to an advertisement." (Id. (emphasis in original))

Claim 16 of the '464 Patent concerns "[t]he method of claim **1**, wherein the machine-readable instructions comprise a hyperlink to a URL." (Id. (emphasis in original))

Claim 18 of the '464 patent concerns:

> A method comprising:
>
> receiving, by a computer system including at least one computer, associated information related to an action to be performed in association with a first electronic media work identifier;
>
> receiving, by the computer system, a first electronic media work;
>
> correlating, by the computer system using a non-exhaustive, near neighbor search, the first electronic media work with the first electronic media work identifier;
>
> storing, by the computer system, correlation information associating the first electronic media work and the first electronic media work identifier;
>
> generating, by the computer system, a tag associated with the first electronic media work;
>
> providing, from the computer system to a first user electronic device, the first electronic media work and the tag;
>
> receiving, at the computer system, a request generated at the first user electronic device and related to the tag;
>
> generating, using the computer system, machine-readable instructions based upon the associated information to be used in performing, at the user electronic device, the action; and

providing, from the computer system to the first user electronic device, the machine-readable instructions to perform the action in response to the request.

(Id. at col. 25-26).

Claim 25 of the '464 Patent concerns "[t]he method of claim **18**, wherein the first electronic media work is received from a first electronic device, the associated information is received from a second electronic device, and the first electronic device, the second electronic device, and the user electronic device are different from one another." (Id. at col. 26 (emphasis in original))

Claim 27 of the '464 Patent concerns "[t]he method of claim **18**, wherein the associated information is related to an advertisement." (Id. (emphasis in original))

Claim 33 of the '464 Patent concerns "[t]he method of claim **18**, wherein the machine-readable instructions comprise a hyperlink to a URL." (Id. (emphasis in original))

C. Defendants' Websites

Defendants operate the website www.youtube.com and the mobile website m.youtube.com and related mobile applications (collectively, "YouTube"). (See Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 21) YouTube allows internet users to upload content – whether video, audio, or melody – to the internet, where content is generally viewable by the public. (See id. ¶¶ 22-24)

Google employs a "Content ID" system in connection with YouTube. The Content ID system allows content owners – "e.g., individuals and entities that own rights to music, television shows, and movies" – to control how their content is used on YouTube. (Id. ¶ 22) The Content ID system determines "whether videos uploaded by YouTube users contain [] video, audio, or melody content" that "belongs" to another person – for example, a copyright holder. (Id. ¶¶ 23-24; Pltf. R.56.1 Counterstmt. (Dkt. No. 240-61) ¶ 23) "For example, if a

YouTube user uploads a video of herself dancing to a popular song, then the Content ID system may generate a match between the . . . user-uploaded video and . . . the popular song (i.e., the reference work)" and take some predetermined action based on that match. (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 25) The Content ID system generates matches by comparing uploaded videos ("query works") to a database of reference works. The reference works may have been uploaded to YouTube by users, or otherwise provided to YouTube by the reference work's author or owner, or another rightsholder. (See id. ¶¶ 28, 32)

According to Plaintiff, there are two versions of Google's Content ID system that infringe on Plaintiff's patents: an "older" version known as the "LSH" version, and a "newer" version known as "Siberia." (See id. ¶¶ 26-27) Implementation of the Siberia system began in approximately 2014. (See Pasula Dep. (Dkt. No. 240-5) at 11)

1. The LSH Version of Content ID

The LSH version of Google's Content ID system generates "fingerprints" that each represent an individual piece of "video, audio, [or] melody content . . . uploaded or otherwise provided to YouTube." (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶¶ 69-70) Each fingerprint is comprised of several "subfingerprints" corresponding to short snippets of that content. (Id. ¶ 70) Subfingerprints for both query works and reference works are generated in the same manner. (Id. ¶¶ 71-72) For indexing purposes, subfingerprints are organized into [redacted] called "locality sensitive hashing" ("LSH") bands. (Id. ¶¶ 73-75) "The number of unique LSH bands is finite; specifically, there are [redacted]" and the same LSH band could be associated with multiple videos. (Id. ¶¶ 77-78)

"[T]he LSH index [can] be visualized as a 'table' in which each unique LSH band is assigned its own 'row' and each reference video is assigned its own 'column.'" (Id. ¶ 84)

Indeed, the structure used to store the LSH bands for reference videos is known as Big Table. (Pltf. R. 56.1 Counterstmt (Dkt. No. 240-61) ¶ 159; Erbo Dep. (Dkt. No. 240-3) at 75 ("[The LSH Version of Content ID was] implemented in terms of a Google Technology called Big Table, which is a distributed key value store.")) Each new reference video added to the LSH index represents a new column in the table, reflecting the LSH bands associated with the new reference video. (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 91-93)

"Stage I of the LSH version of the Content ID system [begins] by searching [the] index . . . for any LSH bands [associated with reference works] that are exact matches to any of the [query] LSH bands of the user-uploaded video." (Id. ¶ 80) "A search of the LSH index using a particular query LSH band searched only the row assigned to that particular LSH band and did not search any of the other rows in the conceptual table." (Id. ¶ 85) In other words, a search of the LSH index returns only the references associated with a particular LSH band, and [redacted] (Pltf. R. 56.1 Counterstmt (Dkt. No. 240-61) ¶¶ 159-62)

The output for a Stage I search of the LSH version of Content ID is a list of all of the reference videos associated with the query LSH bands of a newly uploaded video, "as well as the pertinent point(s) in time in each reference video with which the LSH band[s] are associated." (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 87) "A typical user-uploaded or reference video [redacted], and one subfingerprint corresponds to only a short snippet or frame of video, audio, or melody content." (Id. ¶ 90)

The "index hits" returned by a Stage I search are then further processed "to eliminate candidates unlikely to be a match, which involves the use of various thresholds that compare features extracted from reference work to features extracted from the [query video]." (Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 201; see also Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 94) The "projection filter" first analyzes the videos by [redacted] to determine whether the query video and a particular reference video share sufficient similarities over time – that is, over enough time of the reference video – to be considered a match.[4] (Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 202)

Stage II of the LSH search compares full fingerprints of query videos to each reference video to determine the number of "raw matches." (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 96)

The raw matches are then passed through the "claiming logic" to determine whether the owner of the relevant reference video could "claim" the matching portion of the query work and which "match policy" should be applied to the query work. (Id. ¶¶ 97-99)

2. The Siberia Version of Content ID

The Siberia version of Google's Content ID system generates "embeddings" corresponding "to a short snippet or frame of [the] video, audio, or melody content" uploaded to YouTube. (Id. ¶ 29) As explained by Google, each embedding represents a single frame in a video, and represents a point in a [redacted]. (Id. ¶ 30; Pasula Dep. (Dkt. No. 240-

[4] The Court understands "Hamming similarities" to refer to a form of "Hamming distance," which generally measures "the number of . . . places in which [works] differ from one another." Andrew Butterfield, et al., A Dictionary of Computer Science (7th ed. 2016). Here, "Hamming similarities" refer to the number of places in which works are similar. (See Mitzenmacher Dep. (Dkt. No. 240-9) at 292 ("[T]he [H]amming similarity . . . essentially counts the number of matching positions. . . . [I]n this case, the score is meant to correspond to a level of similarity between the two objects specifically.")).

5) at 22-24 ("[An embedding] . . . is a point in a [redacted][,] . . . a vector which is a description of a point in space. . . . [A]n individual embedding . . . [is] a single frame [in a video]."')) For each video uploaded to YouTube, Siberia generates a "'sequence of embeddings' corresponding to the [work's] video, audio, and melody content." (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 28 (quoting Pasula Dep. (Dkt. No. 240-5) at 29)) The embeddings are generated by a [redacted] that is part of a Google artificial intelligence project. (Id. ¶ 31) The same process is used to create both the "query" embeddings "corresponding to videos uploaded by YouTube users" and the "reference" embeddings "corresponding to content . . . provided or identified by copyright holders or other YouTube partners." (Id. ¶ 32)

The reference embeddings are then "further manipulated" into uniformly structured [redacted] which are in turn stored in multiple references indices for searching. (Id. ¶¶ 33-35; Pasula Dep. (Dkt. No. 240-5) at 45-46 ([redacted])) The hashing enables the Siberia system to store the reference embeddings in a smaller form and to search the reference indices more quickly. (See Pasula Dep. (Dkt. No. 240-5) at 47, 56 ([redacted])) "The reference indices that are searched as part of the Siberia Version of the Content ID system are [redacted]."[5] (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 35)

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[5] Plaintiff denies that the indices store only "hash values," and contends that "complete embeddings for the reference work are also retained in the reference index and are used for comparisons as part of the Siberia system search algorithm." (Pltf. R. 56.1 Counterstmt. (Dkt. No. 240-61) ¶ 35) In support of this assertion, Plaintiff cites an excerpt from a report prepared by Dr. Michael Mitzenmacher, its expert witness. The excerpt cited by Plaintiff states, however, that "[t]he [redacted] of each embedding is what is stored in the reference index."

The Siberia Content ID system contains multiple indices that are organized primarily by content type, for example, video as opposed to audio. (See Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 220 ("Each of the reference indices (video, audio, and melody) is comprised of [redacted] of the embeddings."); see also Pasula Dep. (Dkt. No. 240-5) at 32-33 ("A. . . . [redacted] . . . . There is one index for melody . . . Q. How many indexes for video are there? A. For this copyrighted content, just one. . . . [There are also] [redacted] [redacted]"))

Each of the reference indices is structured in the same manner. (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 36) Each index is "sharded," meaning that the index is "divided into a bunch of smaller indexes," known as shards, "that can each fit on one [computer]." (Pasula Dep. (Dkt. No. 240-5) at 39; see Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 39) For example, the large [redacted] (the "Video Index") has [redacted]. (Pasula Dep. (Dkt. No. 240-5) at 39; Def. R. 56.1 Stmt. (Dkt. No. 225) ¶¶ 39-40) An index for different content might have a different number of shards. (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶¶ 39-40) [redacted]

(Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 219; see also id. ¶ 220 ("Each of the reference indices (video, audio, and melody) is comprised of [redacted] of the embeddings.")) And while the Dr. Mitzenmacher states that, at the final step of the search process, query embeddings are compared directly to reference embeddings – rather than to [redacted] as in earlier stages of the search (id. ¶¶ 225-26) – that does not mean the indices "retain" "complete embeddings" in addition to hash values for each reference work. (Pltf. R. 56.1 Counterstmt. (Dkt. No. 240-61) ¶ 35) The original query embeddings can be recovered from the indexed hashes. (See Pasula Dep. (Dkt. No. 240-5) at 46-47 ("A. . . . [redacted] . . . . [redacted] A. Yes."))

(Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 42) Within the Video Index, for example, [redacted]. (See Pasula Dep. (Dkt. No. 240-5) at 40)

Within each shard, the hash values are further [redacted] (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 37) [redacted] (Pasula Dep. (Dkt. No. 240-5) at 43-44 [redacted] Each shard has [redacted]. (Id.; Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 221))

The search performed by the Siberia Content ID system has "three main stages: 'Index Lookup,' 'Sparse,' and 'Verifier.'" (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 43) As discussed above, when a new video is uploaded to YouTube, the Siberia system generates a sequence of embeddings, with each individual embedding corresponding "to a short snippet or frame of that . . . content." (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 29) Those embeddings may be referred to as the [redacted] (See Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 219)

Using the Video Index as an example, at the Index Lookup stage – sometimes referred to as the "ScaM" algorithm stage, because it was developed by Google's "Scalable Matching [] research team" team (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 58) – query embeddings

are compared [redacted]. (Mitzenmacher Rpt. (Dkt. No. 226-6) ¶¶ 222-223 ("To be clear, the system examines [redacted]."); Def. R. 56.1 Stmt. (Dkt. No. 225) ¶¶ 45-47; Pasula Dep. (Dkt. No. 240-5) at 54 ("[U]p to [redacted] or something like that would be passed [redacted]".")) The Index Lookup then "[redacted]" for each shard, and then compares the query embeddings to all of the hash values in each of those [redacted]. (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶¶ 48-49; Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 223 ("The Content ID Siberia Version then examines each of the [redacted]."))

In or about August 2020, Google modified the Index Lookup step for one of its indexes to [redacted] in a YouTube-wide effort to cut costs. (See Pltf. Ex. 86 (Dkt. No. 274-2) at 6 (YouTube presentation indicating [redacted]; Supp. Konrad Dep. (Dkt. No. 274-3) at 30-31 (discussing an internal Google document that [redacted]))

The Index Lookup step outputs the [redacted]. (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶¶ 51-52) Accordingly, for a search in the Video Index, the Index Lookup step outputs a total of 12,500 hash values. (Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 223)

At the "Sparse" stage, these [redacted] – also referred to as "index hits" – are then further analyzed through a process called "sparse refiner," or "[S]parse." (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶¶ 59, 60) [redacted]. (Id. ¶ 60; Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 224) Some reference works may have [redacted]. (See Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 224) The Sparse process [redacted]. (See id.; Pasula Dep. (Dkt. No. 240-5) at 60, 63, 239-240 (noting that there [redacted]))

Finally, the reference videos that pass the Sparse process proceed to the "Verifier" stage, where "[redacted]." (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 61) "The [V]erifier determines whether a portion of any one or more of the references [redacted]." (Id. ¶ 62)

Google has utilized "at least two versions of the [V]erifier." (Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 226) An earlier version [redacted]. (Id.) The more recent version [redacted] (Id.) The final matches output

from the Verifier are assigned a [redacted]. (Id. ¶ 228)

The Siberia Contact ID's "claiming system" then determines whether [redacted]. (Id.)

II. PROCEDURAL HISTORY

The Complaint in 14 Civ. 2396 was filed on April 4, 2014, and alleges that Defendants' Content ID system infringes on the '988 and '237 Patents.[6] (Cmplt. (Dkt. No. 2)) The Complaint in 14 Civ. 9558 was filed on December 3, 2014, and alleges that Defendants' Content ID system infringes on the '464 Patent. (14 Civ. 9558, Cmplt. (Dkt. No. 1)) Defendants filed their Answer in 14 Civ. 2396 on May 23, 2014, and filed their Answer in 14 Civ. 9558 on January 23, 2015. (Ans. (Dkt. No. 22); 14 Civ. 9558 Ans. (Dkt. No. 11)) On June 9, 2014, this Court entered a civil case management plan in 14 Civ. 2396. (Dkt. No. 31)

A. *Inter Partes* Review

In a June 30, 2015, joint letter, the parties informed the Court that Google had petitioned the U.S. Patent and Trademark Office (the "PTO") to institute inter partes review ("IPR") of, inter alia, the '237 Patent and the '988 Patent.[7] (Dkt. No. 83) Accordingly, on July

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[6] The Complaint also alleges claims regarding two other patents, but Plaintiff's claims regarding those patents were later dismissed by stipulation. (Dkt. No. 134)

[7] "'[I]nter partes review[]' . . . allows private parties to challenge previously issued patent claims in an adversarial process before the Patent Office that mimics civil litigation." SAS Inst., Inc. v. Iancu, 138 S. Ct. 1348, 1352 (2018). "Once inter partes review is instituted, the Patent Trial and Appeal Board [the "PTAB"] – an adjudicatory body within the [PTO] created to conduct inter partes review – examines the patent's validity. . . . The [PTAB] sits in three-member panels of administrative patent judges. . . . During the inter partes review, the petitioner and the patent owner are entitled to certain discovery . . . ; to file affidavits, declarations, and written memoranda . . . ; and to receive an oral hearing before the Board. . . ." Oil States Energy Servs., LLC v. Greene's Energy Grp., LLC, 138 S. Ct. 1365, 1371 (2018) (citing 35 U.S.C. §§ 6, 316).

2, 2015, this Court stayed both actions pending resolution of the PTAB's IPR proceedings. (Dkt. No. 85; 14 Civ. 9558 Dkt. No. 35)

The proceedings before the PTAB turned on the disputed claim term "non-exhaustive search":

> In its decision instituting review of the '179 patent, the [PTAB] construed a "non-exhaustive search" as "a search that locates a match without a comparison of all possible matches." Google Inc. v. Network-1 Techs., Inc., IPR2015-00343, 2015 WL 3902007, at *3–4 (P.T.A.B. June 23, 2015) ("Institution Decision") (emphasis added). In so doing, the Board declined to adopt Google's construction of the term: "a search that locates a match without conducting a brute force comparison of all possible matches, and all data within all possible matches." Institution Decision at *3. Thereafter, in its final decision with respect to the '179 patent, the Board maintained its construction of "non-exhaustive search." Final Decision at *2. Based upon that construction, the Board determined that Google had failed to demonstrate that the cited prior art rendered the challenged claims of the '179 patent unpatentable as either anticipated or obvious.

Google LLC v. Network-1 Techs., Inc., 726 F. App'x 779, 781 (Fed. Cir. 2018) (emphasis in original).[8]

Google appealed the PTAB's decision to the Federal Circuit. In a March 26, 2018 decision, the Federal Circuit vacated the PTAB's decision, adopted Google's construction of the claim term "non-exhaustive search," and remanded to the PTAB for further proceedings. Id. at 786-87.

The Federal Circuit began its analysis by noting that the parties agreed that, "in conducting its inter partes review of the Network-1 Patents, the Board was required by its rules

[8] The Federal Circuit and the PTAB considered four of Plaintiff's patents: the '988 Patent and '237 Patent at issue here, as well as Patent Nos. 8,640,179 (the "'179 Patent") and 8,656,441 (the "'441 Patent"). See id. at 780. Because the parties "agree[d] that the written description of the '179 patent is representative, and that [the Federal Circuit's] determination of the correct construction of 'non-exhaustive search,' as it appears in claim 1 of the '179 patent, disposes of the claim construction issue in all four of the Network-1 Patents," the Federal Circuit "focus[ed] [its] discussion on the '179 patent." Id. at 781.

to apply the broadest reasonable construction of the term 'non-exhaustive search' in light of the patents' specifications." Id. at 782.

The Federal Circuit also noted that the parties agreed,

> as they did before the [PTAB], that the linchpin of the claim construction analysis in this case is determining what an "exhaustive search" is. . . . That is so because a "non-exhaustive" search necessarily is a search that is not "exhaustive." Put another way, the claim limitation at issue does not require a search that employs a stated method (an "exhaustive" search). Rather, it requires a search that does not employ a stated method (a "non-exhaustive" search). As a result, in terms of claim construction, what must be determined is the meaning of the word "exhaustive." In that regard, before the Board, the parties agreed, and the Board concurred, that, generally, an "exhaustive" search means a "brute-force" search that sequentially considers all possible matches revealed in a search. Institution Decision at *3. Further, in the Institution Decision, the Board stated that a "non-exhaustive" search "encompasses anything other than a 'brute-force' search." Id. at *4. Where the parties part company is with respect to the degree of exhaustion required in order for a search to be "exhaustive."
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> Google argues that the Board erred in accepting Network-1's contention that a search qualifies as "exhaustive" as long as it considers "any portion of each potential match—even a single bit of a long string." . . . As it did before the Board, Google urges that, instead, an "exhaustive" search must consider all data within each potential match, because only such a search will ensure "find[ing] the correct answer." . . . For example, consider a musical identification system in which each known piece in a database contains two parts, an introduction and a chorus. If the system compares an unknown melody to every known work in the database, but does so only on the basis of the database songs' introductions, the search is not "exhaustive" because it ignores the choruses. Thus, Google would argue, both the introduction (first part) and the chorus (second part) of each song in the database must be checked in order for a search to be "exhaustive."
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> Google's argument is based upon the proposition that the broadest construction of "non-exhaustive" searching corresponds to the narrowest construction of "exhaustive" searching. According to Google, the narrowest construction of "exhaustive" searching requires considering the entirety of each potential match, not just a single part of it.

Id. at 782-83 (footnotes omitted) (emphases in original).[9]

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[9] The Federal Circuit offered another illustration of the Board's construction v. Google's construction: "[A] database of court names contains a potential match 'Court of Appeals for the Federal Circuit,' and the query is 'Federal Circuit.' The Board's construction would find a search 'exhaustive' if it looked at the first letter of the query, 'F,' determined that it did not match 'C,' and moved on – even if the search was a neighbor search rather than a search for

The Federal Circuit concluded that "[o]f the two competing constructions, Google's is, in fact, broader." Id. at 784. "That is because Google's construction (through its narrower construction of 'exhaustive') necessarily encompasses all of the searches covered by the Board's construction. The Board's construction (through its broader construction of 'exhaustive'), on the other hand, does not necessarily encompass all of the searches covered by Google's construction." Id. The Federal Circuit went on to find that because the "intrinsic and extrinsic evidence" was "inconclusive as to the broader or narrower construction," Google's construction was the broadest reasonable interpretation of "non-exhaustive search." Id. at 786.

B. *Markman* Hearing

On January 2, 2019, the Court entered a stipulation and order lifting the stays that had been in place since July 2, 2015. (Dkt. No. 134; 14 Civ. 9558 Dkt. No. 79) The parties agreed to terminate the IPR proceedings and narrow the claims asserted by Plaintiff in 14 Civ. 2396 to claim 17 of the '988 Patent and claims 33-35 of the '237 Patent. (Dkt. No. 134; 14 Civ. 9558 Dkt. No. 79)

On April 30, 2019, the parties filed an Amended Joint Claim Construction Chart. (Dkt. No. 146) The parties claim construction briefing was fully submitted on August 9, 2019. (See Def. Claim Construction Sur-Reply (Dkt. No. 163))

On November 21, 2019, the Court conducted a Markman hearing. (Markman Tr. (Dkt. No. 204)) In a June 29, 2020 order, the Court informed the parties that it would "decide claim construction and summary judgment simultaneously," and directed the parties to "submit a

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exact matches only. Similarly, if the query were 'Federal Circuit' and the database entry were 'First Circuit,' considering only the first letter would produce a false positive under the Board's construction. . . . Google's construction avoids false positives and false negatives by considering all the data within a match." Id. at 786.

joint letter that includes an agreed-upon briefing schedule for summary judgment." (Dkt. No. 219)

C. Summary Judgment

The parties' cross motions for summary judgment were initially fully briefed on November 11, 2020. (Dkt. Nos. 223-241) On July 11, 2022, the Court ordered the parties to provide additional briefing addressing the impact of supplemental discovery conducted by the parties after their cross-motions for summary judgment had been filed. (Dkt. No. 266) Plaintiff filed a supplemental brief in opposition to Defendants' motion for summary judgment on September 23, 2022, and Defendants' filed a response on September 30, 2022. (Dkt. Nos. 274, 278)

DISCUSSION

I. CLAIM CONSTRUCTION

A. Legal Standards

Claim construction is a question of law to be determined by the Court. See Markman v. Westview Instruments, Inc., 517 U.S. 370, 388-89 (1996). When determining the scope of a patent, "[t]he words of a claim are generally given their ordinary and customary meaning as understood by a person of ordinary skill in the art when read in the context of the specification and prosecution history." Thorner v. Sony Computer Entm't Am. LLC, 669 F.3d 1362, 1365 (Fed. Cir. 2012); see also Medrad, Inc. v. MRI Devices Corp., 401 F.3d 1313, 1319 (Fed. Cir. 2005) ("We cannot look at the ordinary meaning of the term . . . in a vacuum. Rather, we must look at the ordinary meaning in the context of the written description and the prosecution history."); V-Formation, Inc. v. Benetton Group SpA, 401 F.3d 1307, 1310 (Fed. Cir. 2005) (intrinsic record "usually provides the technological and temporal context to enable

the court to ascertain the meaning of the claim to one of ordinary skill in the art at the time of invention"); Unitherm Food Sys., Inc. v. Swift-Eckrich, Inc., 375 F.3d 1341, 1351 (Fed. Cir. 2004) (proper definition is the "definition that one of ordinary skill in the art could ascertain from the intrinsic evidence in the record").

There are two exceptions to this rule: "1) when a patentee sets out a definition and acts as his own lexicographer, or 2) when the patentee disavows the full scope of a claim term either in the specification or during prosecution." Thorner, 669 F.3d at 1365. Neither exception is relevant here.

The "ordinary and customary meaning" of a claim term should first be determined by the intrinsic evidence, which consists of the claims, the specification, and the prosecution history. See, e.g., Primos, Inc. v. Hunter's Specialties, Inc., 451 F.3d 841, 847-48 (Fed. Cir. 2006); Kinik Co. v. ITC, 362 F.3d 1359, 1365 (Fed. Cir. 2004). The patent specification is an important guide to claim construction. See, e.g., Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1582 (Fed. Cir. 1996) ("[T]he specification is always highly relevant to the claim construction analysis. Usually, it is dispositive."); Phillips, 415 F.3d at 1315–16 ("The best source for understanding a technical term is the specification from which it arose, informed, as needed, by the prosecution history.") (quoting Multiform Desiccants, Inc. v. Medzam, Ltd., 133 F.3d 1473, 1478 (Fed. Cir. 1998)). "A fundamental rule of claim construction is that terms . . . are construed with the meaning with which they are presented in the patent document. Thus[,] claims must be construed so as to be consistent with the specification." Merck & Co., Inc. v. Teva Pharms. USA, Inc., 347 F.3d 1367, 1370 (Fed. Cir. 2003) (citations omitted).

"Extrinsic evidence is that evidence which is external to the patent and file history, such as expert testimony, inventor testimony, dictionaries, and technical treatises and

articles." Vitronics, 90 F.3d at 1584. While a district court may consult extrinsic evidence as part of the claim construction analysis, such evidence is considered less reliable than the intrinsic evidence. See, e.g., Phillips, 415 F.3d at 1319 ("[T]he court should keep in mind the flaws inherent in each type of evidence and assess that evidence accordingly.").

"A claim is invalid for indefiniteness if its language, read in light of the specification and prosecution history, 'fail[s] to inform, with reasonable certainty, those skilled in the art about the scope of the invention.'" HZNP Medicines LLC v. Actavis Labs. UT, Inc., 940 F.3d 680, 688 (Fed. Cir. 2019) (quoting Nautilus, Inc. v. Biosig Instruments, Inc., 572 U.S. 898, 901 (2014)). "The 'reasonable certainty' standard established in Nautilus reflects a delicate balance between the inherent limitations of language and providing clear notice of what is claimed." Guangdong Alison Hi-Tech Co. v. Int'l Trade Comm'n, 936 F.3d 1353, 1359 (Fed. Cir. 2019) (internal quotation marks omitted). "[A] patentee need not define his invention with mathematical precision in order to comply with the definiteness requirement[, however]." Id. (internal quotation marks omitted). "At bottom, the indefiniteness test 'mandates clarity, while recognizing that absolute precision is unattainable.'" Focus Prod. Grp. Int'l, LLC v. Kartri Sales Co., Inc., 15 Civ. 10154 (PAE), 2018 WL 3773986, at *7 (S.D.N.Y. Aug. 9, 2018) (quoting One-E-Way, Inc. v. Int'l Trade Comm'n, 859 F.3d 1059, 1063 (Fed. Cir. 2017)). The party asserting indefiniteness has "the burden of proving indefiniteness by clear and convincing evidence." BASF Corp. v. Johnson Matthey Inc., 875 F.3d 1360, 1365 (Fed. Cir. 2017).

B. Agreed-Upon Constructions

The parties having agreed to the following constructions of claim terms in the asserted patents and claims, this Court adopts these constructions for purposes of this action:

Claim Term	Agreed Construction	Asserted Claims in which Term Appears[10]
"sublinear" [search]	"A search whose execution time scales with a less than linear relationship to the size of the data set to be searched, assuming computing power is held constant."	'988 patent: **17** '237 patent: **33**, 34, 35
"neighbor" "near neighbor"	"A close, but not necessarily exact or the closest, match of a feature vector, compact electronic representation, or set of extracted features to another, wherein the distance or difference between the two feature vectors, compact electronic representations, or sets of extracted features falls within a defined threshold."	'988 patent: (**15**), 17 '464 patent: **1**, 8, 10, 16, **18**, 25, 27, 33
"near neighbor search"	"A search using an algorithm designed to identify a close, but not necessarily exact or the closest, match of a feature vector, compact electronic representation, or set of extracted features to another, wherein the distance or difference between the two feature vectors, compact electronic representations, or sets of extracted features falls within a defined threshold."	'464 patent: **1**, 8, 10, 16, **18**, 25, 27, 33
"approximate nearest neighbor search"	"A search using an algorithm designed to identify a close, but not necessarily exact or the closest, match of a feature vector, compact electronic representation, or set of extracted features to another, wherein the distance or difference between the two feature vectors, compact electronic representations, or sets of extracted features falls within a defined threshold."	'237 patent: **33**, 34, 35
"machine-readable instructions"	"code or pseudocode that is executed using a computer processor, i.e., that is discernable by a computer processor and dictates steps to be carried out by one or more computer processors"	'464 patent: **1**, 8, 10, **16**, **18**, 25, 27, **33**

(Am. Jt. Claim Construction Chart (Dkt. No. 146) at 2)

[10] "Bold numbers indicate claims explicitly reciting the claim term. Non-bold numbers indicate claims depending from claims that explicitly recite the claim term. Numbers in parentheses indicate a claim that is not currently asserted [that] recites the claim term, and a claim depending from that non-asserted claim is asserted." (Am. Jt. Claim Construction Chart (Dkt. No. 146) at 2 n.2)

C. Disputed Terms

The parties dispute four claim terms: (1) "non-exhaustive search"; (2) "correlation information"; (3) "extracted features"; and (4) "extracting features."

As discussed below, Plaintiff proposes constructions for all four terms. Defendants propose constructions for "extracted features" and "extracting features," but contend that "non-exhaustive search" and "correlation information" are indefinite.

Claim Terms	Plaintiff's Construction	Defendants' Construction	Asserted Claims in which Term Appears[11]
"non-exhaustive search" "non-exhaustive . . . search"	"A search designed to locate a [near] neighbor without comparing to all possible matches (i.e., all records in the reference data set), even if the search does not locate a [near] neighbor."	Indefinite	'988 patent: **(15), 17** '464 patent: **1**, 8, 10, 16, **18**, 25, 27, 33
"correlation information"	Ordinary meaning. Alternatively: "information that associates the first electronic media work with an electronic media work identifier"	Indefinite.	'464 patent: **1**, 8, 10, 16, **18**, 25, 27, 33
"extracted features"	"Electronic data sampled, calculated, or otherwise derived from a work itself, as opposed to from information added or appended to the work."	"Electronic data derived from a work itself, as opposed to from information added or appended to the work."	'988 patent: (**15**), 17 '237 patent: **33**, 34, 35
"extracting features"	"Sampling, calculating, or otherwise deriving electronic data from a work itself, as opposed to from information added or appended to the work."	"Deriving electronic data from a work itself, as opposed to from information added or appended to the work."	'988 patent: (**15**), 17

(Am. Jt. Claim Construction Chart (Dkt. No. 146) at 3)

[11] See supra n.10.

1. **"Non-Exhaustive Search"**

The chart below depicts the various constructions of "non-exhaustive search" at issue here:

Claim Term	Plaintiff's Construction	Defendants' Construction	Federal Circuit's "Broadest Reasonable Construction"
"non-exhaustive search" "non-exhaustive . . . search"	"A search designed to locate a [near] neighbor without comparing to all possible matches (i.e., all records in the reference data set), even if the search does not locate a [near] neighbor."	Indefinite	"A search that locates a match without conducting a brute force comparison of all possible matches, and all data within all possible matches."

The disputed term "non-exhaustive search" is used in (1) independent claim 15 of the '988 patent, which is not asserted in this case; (2) dependent claim 17 of the '988 patent; and (3) all asserted claims of the '464 patent. (See Pltf. Am. Infringement Contentions (Dkt. No. 226-2) at 2; Am. Jt. Claim Construction Chart (Dkt. No. 146) at 3)

The relevant claims from the '988 patent, with the disputed term underlined, are as follows:

> **15.** A method for associating an electronic work with an action, the electronic work comprising at least one of audio and video, the method comprising:
> a) electronically extracting features from the electronic work;
> b) electronically determining an identification of the electronic work based on the extracted features, wherein the identification is based on a non-exhaustive search identifying a neighbor;
> c) electronically determining an action based on the identification of the electronic work; and
> d) electronically performing the action
>
> **17.** The method of claim **15**, wherein the non-exhaustive search is sublinear.

('988 Patent (Dkt. No. 148-4) at 27)

Defendants argue that "non-exhaustive search" is indefinite because the term "fails to 'provide objective boundaries for those of skill in the art'" in that (1) the intrinsic evidence does not "define the term's contours" and (2) the extrinsic evidence cited by Plaintiff "only amplifies the ambiguity inherent in the phrase 'non-exhaustive search.'" (Def. Claim Construction Br. (Dkt. No. 151) at 15-16 (quoting Interval Licensing, 766 F.3d at 1371))

a. Intrinsic Evidence

(i) Claim Language

While neither side has discussed the claim language, frequently "the claims themselves provide substantial guidance as to the meaning of particular claim terms." Phillips, 415 F.3d at 1314. Here, claim 15 refers to a "non-exhaustive search identifying a neighbor" and claim 17 refers to a "non-exhaustive search [that] is sublinear." ('988 Patent (Dkt. No. 148-4) at 27) The use of this language "strongly implies that the term ['non-exhaustive search'] does not inherently mean" a search that identifies a neighbor or is sublinear. Phillips, 415 F.3d at 1314 ("To take a simple example, the claim in this case refers to 'steel baffles,' which strongly implies that the term 'baffles' does not inherently mean objects made of steel."); see also Enzo Biochem, Inc. v. Applera Corp., 599 F.3d 1325, 1334 (Fed. Cir. 2010) ("'Under the doctrine of claim differentiation, dependent claims are presumed to be of narrower scope than the independent claims from which they depend.'" (quoting AK Steel Corp. v. Sollac & Ugine, 344 F.3d 1234, 1242 (Fed.Cir. 2003)).

Omitting the "neighbor" limitation from the definition of "non-exhaustive search," Plaintiff's proposed construction is "[a] search designed to locate a [match] . . . without comparing to all possible matches (i.e., all records in the reference data set), even if the search

does not locate a [match]. . . ." (Pltf. Claim Construction Br. (Dkt. No. 148) at 14) Aside from this insight, the claims do not shed light on the meaning of "non-exhaustive search."

(ii) Specification

As to the specification, Plaintiff cites the following language:

> The extracted feature vector is then passed to a recognition (e.g., feature look-up) operation, during which, the vector is compared to entries of known vectors **114** in a content identification (WID) database **110**. It is important to realize that the matching of extracted and known vectors is not equivalent to looking up a word in an electronic dictionary. Since the extracted vectors contain noise or distortions, binary search might not be possible. Instead, a statistical comparison is often made between an extracted vector and each stored vector. Common statistical measures include linear correlation and related measures such as correlation coefficient, but other methods can also be used including mutual information, Euclidean distance and Lp-norms. . . .
>
> If binary search was possible, then a database containing N vectors would require at most log(N) comparisons. Unfortunately, binary search is not possible when taking a noisy signal and trying to find the most similar reference signal. This problem is one of nearest neighbor search in a (high dimensional) feature space. In previous work, it was not uncommon to perform a linear search of all N entries, perhaps halting the search when the first match is found. On average, this will require N/2 comparisons. If N is large, this search can be computationally very expensive.
>
> Other forms of matching include those based on clustering, kd-trees, vantage point trees and excluded middle vantage point forests are possible and will be discussed in more detail later.
>
> . . . .
>
> If binary search was possible, then a database containing N vectors would require at most log(N) comparisons. However, in current advertisement monitoring applications there is no discussion of efficient search methods. Thus, a linear search of all N entries may be performed, perhaps halting the search when the first match is found. On average, this will require N/2 comparisons. If N is large, this can be computationally expensive. Consider a situation in which one out of 100,000 possible commercials is to be identified. Each 30-second commercial consists of 900 video frames. If all 900 frames are stored in the database, then N=90,000,000. Even if only every 10th video frame is stored in the database, its size is still nine million. While databases of this size are now common, they rely on efficient search to access entries, i.e., they do not perform a linear search. A

> binary search of a 90,000,000-item database requires less than 20 comparisons. In contrast, a linear search will require an average of 45,000,000!
>
> . . . .
>
> The recognition system described can be considered to be a form of nearest neighbor search in a high dimensional feature space. This problem has been very well studied and is known to be very difficult as the dimensionality of the vectors increases. A number of possible data structures are applicable including kd-trees and vantage point trees. These data structures and associated search algorithms organize a N-point dataset (N=90,000,000 in our previous example) so that sublinear time searches can be performed on average. However, worst-case search times can be considerably longer. Recently, Yianilos proposed an excluded middle vantage point forest for nearest neighbor search. See, e.g., the Yianilos reference. This data structure guarantees sub-linear worst-case search times, but where the search is now for a nearest neighbor within a fixed radius, T. The fixed radius search means that if the database contains a vector that is within X of the query, then there is a match. Otherwise, no match is found. In contrast, traditional vantage point trees will always return a nearest neighbor, even if the distance between the neighbor and the query is very large. In these cases, if the distance between the query and the nearest neighbor exceeds a threshold, then they are considered not to match. This is precisely what the excluded middle vantage point forest implicitly does.

('988 Patent (Dkt. No. 148-8) at col. 8-9, 21-22 (citations omitted))

While the specification states that the "problem . . . of nearest neighbor search in a (high dimensional) feature space" is best solved by application of a search method that is not "computationally very expensive," these descriptions are addressed by the "nearest neighbor" and "sublinear" limitations on which the parties have agreed-to constructions. (Id.)

The Court concludes that the specification does not shed light on the correct interpretation of "non-exhaustive search." Indeed, the words "exhaustive" and "non-exhaustive" do not appear in the specification. And contrary to Plaintiff's arguments, the specification does not list "binary search, clustering, kd-trees, vantage point trees, excluded middle vantage point forests, and searches for neighbors" as "examples of non-exhaustive search methodologies." (See Pltf. Claim Construction Br. (Dkt. No. 148) at 15) Nor does the specification "explain[]

that an exhaustive search potentially requires comparing the query to every record in a data set to be searched" (id.) when discussing a "linear search of all N entries." ('988 Patent (Dkt. No. 148-4) col. 9:25-27) As Google points out, Network-1 made these same arguments during the IPR appeal, and the Federal Circuit rejected them.[12] See Google LLC, 726 F. App'x at 785 ("We do

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[12] The parties dispute the significance of the Federal Circuit decision to this Court's analysis. Defendants argue that the "Federal Circuit addressed" the appropriate construction of "non-exhaustive search" in the IPR appeal, "which involved the same claim term and specifications . . . [and] intrinsic record that Network-1 relies upon here." (Def. Claim Construction Br. (Dkt. No. 151) at 16 (citing Google LLC, 726 F. App'x at 780)) According to Defendants, the "Federal Circuit's opinion expressly rejected Network-1's argument that the specification 'identified' a 'non-exhaustive search' through its description of binary search, clustering, kd-trees, and other search techniques." (Id.) While the Court agrees with that characterization, that ruling is not dispositive here, because a different standard applies.

The Federal Circuit reversed the PTAB's construction of the term "non-exhaustive search" under the "broadest reasonable interpretation standard." Google LLC, 726 F. App'x at 782 ("[T]he Board was required by its rules to apply the broadest reasonable construction of the term 'non-exhaustive search' in light of the patents' specifications.") (citing 37 C.F.R. § 42.100(b)). "[U]nder the broadest reasonable construction standard, where two claim constructions are reasonable, the broader construction governs." Id. at 784. And in order for a broader construction "to be found reasonable, it is not necessary that a claim be given its correct construction under the framework laid out in Phillips v. AWH Corp., 415 F.3d 1303 (Fed. Cir. 2005) (en banc)." Id. (emphasis in original).

Under the Phillips framework, however, where two or more "reasonable" constructions of a term exist, it is possible that a "person of ordinary skill in the art" would find the narrower reasonable construction to be "the [claim term's] ordinary and customary meaning." Phillips, 415 F.3d 1303. The Federal Circuit's analysis of the patent's claims and specification, and its conclusion that they do not render Google's broader construction of "non-exhaustive search" unreasonable, is thus not per se incompatible with a different construction under the Phillips standard. See, e.g., PPC Broadband, Inc. v. Corning Optical Commc'ns RF, LLC, 815 F.3d 747, 756 (Fed. Cir. 2016) ("If we were tasked with reviewing the Board's construction according to Phillips, and in fact if the Board had applied the Phillips standard rather than the broadest reasonable construction, this case would be straight-forward. PPC Broadband's construction is the only construction of the term consistent with the use of the same term throughout the specification. But this case is much closer under the broadest reasonable interpretation standard given the ordinary meanings attributable to the term at issue."); Convolve, Inc. v. Compaq Comput. Corp., 812 F.3d 1313, 1325 (Fed. Cir. 2016) ("Our task is to interpret the scope of the claims per the

not agree, however, that these parts of the specification draw a clear line between 'exhaustive' and 'non-exhaustive' searching in terms of how much data within a record a search must consider in order to qualify as one or the other.").

Finally, it is worth noting that the specification undermines – rather than supports – Plaintiff's proposed construction. While Claims 15 and 17 require a search that "does not employ" an "exhaustive" method, Google LLC, 726 F. App'x at 782, the specification does not state that "linear correlation" or "a linear search of all N entries" should not be used. ('988 Patent (Dkt. No. 148-4) col. 9:1-25) Indeed, the specification describes "linear correlation" as among the "[c]ommon statistical measures" used to compare "an extracted vector [to] each stored vector" (id. col. 9:3-5, 23-25 ("[In solving the] problem . . . of nearest neighbor search in a (high-dimensional) feature space[] . . . it was not uncommon to perform a linear search of all N

Phillips standard. . . . Thus, the examiner's finding under the broadest reasonable interpretation . . . cannot be dispositive.); Personal Audio, LLC v. Google LLC, 2019 WL 1150576, at *11 (D. Del. Mar. 13, 2019) ("[W]hile construing the algorithm at issue to encompass any 'conditional' algorithm might be acceptable under the [broadest reasonable interpretation] standard, it may not be appropriate under the Phillips standard.").

This Court must thus undertake its own review of the intrinsic and extrinsic evidence to determine whether "non-exhaustive search" "fail[s] to inform, with reasonable certainty, those skilled in the art about the scope of the invention." Nautilus, 572 U.S. at 901.

To the extent that Google argues that the "Federal Circuit's decision compels the conclusion that the term is indeed indefinite" (Def. Claim Construction Br. (Dkt. No. 151) at 13), it is mistaken, as a footnote in the Google LLC decision makes clear:

> In the district court, Google has advanced the argument that the claim term "non-exhaustive search" is indefinite. See Nautilus, Inc. v. Biosig Instruments, Inc., – U.S. – , 134 S.Ct. 2120, 2124, 189 L.Ed.2d 37 (2014) ("a patent is invalid for indefiniteness if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention"). In an IPR, the Board cannot declare claims indefinite. See 35 U.S.C. § 311(b). The issue of indefiniteness is therefore not before us, and we express no view on it.

Google LLC, 726 Fed. App'x. at 782 n.3.

entries.")), and states that a linear search "may be performed." (Id. col. 21:23-27) And the specification states that a "binary search" – which Plaintiff cites as an exemplary "non-exhaustive" search methodology (Pltf. Claim Construction Br. (Dkt. No. 148) at 15) – is not "possible" in the context of the invention. ('988 Patent (Dkt. No. 148-4) col. 21:23-27) Similarly, the specification discusses the searches that Plaintiff describes as "non-exhaustive" as "[o]ther forms of matching," without stating that these searches should be used to the exclusion of linear correlation or any other methodology. (Id. col. 9:29-32)

It is also not clear that certain of the embodiments listed in the specification and claims would meet Plaintiff's proposed construction of "non-exhaustive search." A "search designed to locate a [near] neighbor without comparing to all possible matches[,] . . . even if the search does not locate a [near] neighbor," (Pltf. Claim Construction Br. (Dkt. No. 148) at 14), appears to exclude search methodologies that will always locate a neighbor, regardless of how dissimilar the "matched" stored vector is from the query.

The specification notes that in contrast to "an excluded middle vantage point forest[,] . . . traditional vantage point trees will always return a nearest neighbor, even if the distance between the neighbor and the query is very large." ('988 Patent (Dkt. No. 148-4) col. 22 (emphasis added)) And two of the academic papers that Plaintiff contends are incorporated by reference into the '988 Patent (see Pltf. Claim Construction Br. (Dkt. No. 148) at 15-16 & n.6, n.7) state that, "[f]or a worst case query, kd-tree search visits essentially the entire dataset." (Pltf. Claim Construction Br., Ex. 6, Peter N. Yianilos, Excluded Middle Vantage Point Forests for Nearest Neighbor Search, DIMACS Implementation Challenge: Near Neighbor Searches Workshop (1999) (Dkt. No. 148-17) at 2 ("Yianilos I") (Dkt. No. 148-17) at 3; see also id. Ex. 7 Peter N. Yianilos, Locally Lifting the Curse of Dimensionality for Nearest Neighbor Search,

Symposium on Discrete Algorithms (SODA, 2000) ("Yianilos II") (Dkt. No. 148-18) at 3 ("[Under certain circumstances] the kd-tree can confidently prune almost nothing." (emphasis in original))) "Traditional vantage point trees" and "kd-trees" are claimed as forms of "non-exhaustive" searches in claims 18 and 19 ('988 Patent (Dkt. No. 148-4) col. 26) despite potentially requiring "visiting essentially the entire dataset" for "a worst case query." (Yianilos I (Dkt. No. 148-17) at 3)

"[T]here is a strong presumption against a claim construction that excludes a disclosed embodiment." In re Katz Interactive Call Processing Pat. Litig., 639 F.3d 1303, 1324 (Fed. Cir. 2011). While it is not entirely clear that Plaintiff's construction excludes these embodiments, nothing in the specification suggests that these embodiments fall within Plaintiff's proposed construction – i.e., that they do not require comparing a query "to all possible matches" at least some of the time, under "worst case" circumstances. Indeed, the specification states that these search methodologies may be useful because "on average" they lead to "sub-linear time searches." (See '988 Patent (Dkt. No. 148-4) col. 22) Sublinearity thus is their salient feature, not "non-exhaustiveness."

In sum, to the extent the specification distinguishes some types of searches from others, the relevant fault line is not "exhaustiveness" as defined in Plaintiff's briefing and proposed construction.

b. Extrinsic Evidence

Having concluded that the intrinsic evidence does not suggest a particular construction of "non-exhaustive search," the Court turns to the extrinsic evidence proffered by the parties.

Plaintiff cites first to the declaration of Dr. Michael Mitzenmacher, its expert witness. "Extrinsic evidence in the form of expert testimony can be useful to a court for a variety of purposes, such as to provide background on the technology at issue, to explain how an invention works, to ensure that the court's understanding of the technical aspects of the patent is consistent with that of a person of skill in the art, or to establish that a particular term in the patent or the prior art has a particular meaning in the pertinent field." Phillips, 415 F.3d at 1318 (collecting cases). "However, conclusory, unsupported assertions by experts as to the definition of a claim term are not useful to a court." Id.

Here, Dr. Mitzenmacher opines that "'non-exhaustive search' is a term that is well understood by skilled artisans in the field . . . [and that] Network-1's proposed definition accurately reflects the ordinary meaning of this term that would have been understood by persons of ordinary skill in the art at the time of the patents." (Mitzenmacher Decl. (Dkt. No. 148-1) ¶¶ 40-41) The Mitzenmacher declaration repeats the arguments made in Plaintiff's brief, including that the '988 Patent's specification distinguishes between exhaustive and non-exhaustive searches in its comparison of "linear search" to "several examples of non-exhaustive . . . searches," such as binary search, kd-trees, vantage point trees, and excluded middle vantage point forests. (Id. ¶¶ 42-47) Dr. Mitzenmacher concludes that "the difference between exhaustive and non-exhaustive searches turns on the number of comparisons that must be performed between the query and the reference data set to be searched," and "that an exhaustive search may involve comparing a query to every record in the data set," whereas a non-exhaustive search does not. (Id. ¶¶ 41-43)

Because Dr. Mitzenmacher's declaration largely rehashes arguments made in Plaintiff's briefing, it is of little value as extrinsic evidence. See Bushnell Hawthorne, LLC v.

Cisco Sys., Inc., 18 Civ. 760, 2019 WL 2745735, at *5 n.5 (E.D. Va. July 1, 2019), aff'd, 813 F. App'x 522 (Fed. Cir. 2020) ("[P]laintiff's expert declaration in large part simply repeats arguments that plaintiff makes in its brief, which do not require the aid of an expert to consider and resolve here. Accordingly, plaintiff's expert declaration is not entitled to any significant weight."). Moreover, Dr. Mitzenmacher's "ultimate opinion about the meaning of [non-exhaustive search] is a legal opinion, which is outside his area of expertise." IBSA Institut Biochimique, S.A. v. Teva Pharms. USA, Inc., 18 Civ. 555 (RGA), 2019 WL 3936656, at *6 n.5 (D. Del. Aug. 20, 2019), aff'd, 966 F.3d 1374 (Fed. Cir. 2020); id. ("That is why expert opinions on claim construction are usually worthless.").

In any event, Dr. Mitzenmacher's opinion regarding the meaning of non-exhaustive search – as set forth in his declaration – is undermined by his deposition testimony.

As discussed above, in his declaration Dr. Mitzenmacher states that "an exhaustive search may involve comparing a query to every record in the data set." (Mitzenmacher Decl. (Dkt. No. 148-1) ¶ 42) At his deposition, however, Dr. Mitzenmacher testified that a search that "prunes" potential matches from a dataset without directly comparing the query to those entries is nonetheless "exhaustive":

> Q. You used the term "pruning" before. What did you mean by that?
>
> A. . . . [S]o one way of viewing an exhaustive search is by looking at it as a tree[.] . . . And so if you were saying . . . I need an exact match, I need a word that starts with C, and you said, Okay, well, I'm starting at the dictionary and this page of the dictionary, you know, is the first branch, and all it has are A's on it, then I could say, A-ha, well, I've actually done a comparison against every word on that page because I know that every word on that page starts with A. But I don't need to actually do . . . 1,000 A comparisons to determine that [a word that starts with C will not appear on that page]. That corresponds to a pruning and then a backtracking approach, where the backtracking means, I can move to the next page. That's still exhaustive.
>
> Q. Would that still be exhaustive?

A. Yes. Yes.

Q. That example you just gave is an exhaustive search?

A. Yes. According to Denny. And that's also how I would describe it also.

(Mitzenmacher Dep. (Dkt. No. 153-12) at 174-75)

Dr. Mitzenmacher's testimony – that an exhaustive search may not "need to actually do . . . 1,000 [] comparisons" to eliminate 1,000 potential matches – is inconsistent with Plaintiff's proposed construction of "non-exhaustive" search. (Id.) Because pruning algorithms can "locate a [match] without comparing to all possible matches (i.e., all records in the reference data set)," (Pltf. Claim Construction Br. (Dkt. No. 148) at 14), they would fall within Network-1's definition of "non-exhaustive" rather than exhaustive searches. Dr. Mitzenmacher's testimony thus highlights the uncertain boundaries between exhaustive and non-exhaustive search methods.

Because (1) Dr. Mitzenmacher's declaration does little more than repeat the arguments in Plaintiff's claim construction briefing; and (2) Dr. Mitzenmacher's deposition testimony undermines Plaintiff's proposed construction and the assertions in Dr. Mitzenmacher's declaration, Dr. Mitzenmacher's opinion is entitled to little weight.

Plaintiff also cites to several academic papers that provide definitions of "exhaustive search" and "non-exhaustive search." These definitions are of limited value here, but it is worth noting that they differ from Plaintiff's proposed construction.

For example, the Denny excerpt – cited by Dr. Mitzenmacher at deposition – defines exhaustive search and non-exhaustive search as follows:

> Exhaustive search is a technique for constructing or examining all possible states within a given search space. . . . In contrast, non-exhaustive search strategies, such as the probabilistic algorithms studied in the previous chapter, traverse the search space more or less at random and thus certain states may never be examined.

(Pltf. Claim Construction Br., Ex. 8, Paul C. Denny, Search and Enumeration Techniques for Incidence Structures ("Denny") (Dkt. No. 148-19) at 10)

Plaintiff's proposed construction is inconsistent with Denny's in that it does not require that the claimed search methods "traverse the search space more or less at random." (Id.) There is no evidence in the record that binary search, or any of the other search methodologies discussed in the specification, proceed in this fashion. The Denny excerpt proffered by Network-1 also describes "backtracking" as a "technique for performing exhaustive search," wherein partial "feasible solutions" are examined systematically to determine if a dataset contains a match. (Id. at 10-12) Once a "partial solution . . . has been constructed and the feasibility property $F_k(a_1, a_2, \ldots, a_k) = \textit{false}$, then it is known . . . [that] no extension of the partial solution $(a_1, a_2, \ldots, a_k)$ can possibly form a valid complete solution. As soon as this situation is detected, it is then possible to eliminate from consideration [other] infeasible solutions." (Id. at 12) Denny thus describes as "exhaustive" a search technique that can "eliminate from consideration" certain solutions in a dataset without directly comparing them to the search query.[13]

Using as an example a dictionary search regarding the query word "cube," Denny describes a search that could eliminate from the list of possible solutions every word in the

[13] Plaintiff attempts to disclaim Denny's description of such "pruning techniques" as exhaustive. According to Plaintiff, "Denny's 'pruning' relates to the length of time needed for individual comparisons (which Denny explains could be stopped early when the search determines that there is no match based on that comparison), not the number of comparisons needing to be performed." (Pltf. Claim Construction Br. (Dkt. No. 148) at 13-14 n.10) Plaintiff's characterization of Denny's "pruning" is incorrect. Denny plainly states that pruning "significantly reduce[s] the required execution time of [backtracking] algorithm[s]" by considering "partial feasible solutions" and eliminating "infeasible solutions," without considering each individual solution. (See Denny (Dkt. No. 148-19) at 11-12) This search – which Denny describes as "exhaustive" – would be considered "non-exhaustive" under Plaintiff's construction, because it does "not potentially require a comparison to all records in a data set." (Pltf. Claim Construction Br. (Dkt. No. 148) at 15-19)

dictionary beginning with the letters A or B, without any comparison of the query word with a word that begins with one of those letters. The search would likewise eliminate every word beginning with "ca," without comparing the cube query word with, for example, the words "candy" or "crabapple." While Denny would describe this search as exhaustive, it would be "non-exhaustive" under Plaintiff's proposed construction.

Another article cited by Plaintiff in support of its proposed construction defines "exhaustive search" as "[t]he technique of generating and analyzing all of the possible states of a situation." (Pltf. Claim Construction Br., Ex. 9, Jon Orwant et al., Mastering Algorithms with Perl (1999) ("Orwant") (Dkt. No. 148-20) at 4) Orwant's definition of exhaustive search appears similar to Plaintiff's – a search that "potentially requires comparing the query to every record in a data set to be searched." (Pltf. Claim Construction Br. (Dkt. No. 148) at 15) Orwant notes, however, that "the definition of exhaustive search is vague. The exact meaning of 'try everything' depends upon the particular problem. Each problem has its own way of trying everything, and often many different ways." (Orwant (Dkt. No. 148-20) at 7) Orwant's analysis highlights that while the term "exhaustive search" might, in a general sense, mean "try everything" (id.), the '988 and '464 Patents do not discuss what "exhaustive" or "non-exhaustive" search means in the context of a "nearest neighbor search in a high dimensional feature space." ('988 Patent (Dkt. No. 148-4) col. 22)

In sum, the extrinsic evidence does not support Plaintiff's proposed construction. As discussed above, Dr. Mitzenmacher's declaration merely parrots the arguments in Plaintiff's briefing, and the opinions expressed in the declaration are undermined by his testimony that pruning search algorithms are exhaustive, even though these searches do not search the entirety of the reference set, and thus fall within Plaintiff's proposed construction of "non-exhaustive

search." The limited external sources Plaintiff cites likewise do not support Plaintiff's construction. Indeed, the extrinsic evidence merely highlight the vague nature of "exhaustive search" and "non-exhaustive search."[14]

* * * *

The Supreme Court and the Federal Circuit have instructed that "there is an indefiniteness problem if the claim language 'might mean several different things and no informed and confident choice is available among the contending definitions.'" Interval Licensing, 766 F.3d at 1371 (quoting Nautilus, Inc. v. Biosig Instruments, Inc., 572 U.S. 898, 911 (2014)). Consistent with this guidance, district courts have found claim terms indefinite where multiple reasonable definitions exist and the evidence does not provide reasonable certainty as to which definition is correct. See dunnhumby USA, LLC v. emnos USA Corp., 13 Civ. 399, 2015 WL 1542365, at *18 (N.D. Ill. Apr. 1, 2015) ("Based on the lack of guidance in the intrinsic evidence and the additional meanings of the term in the extrinsic evidence, the Court finds the term 'selection of a query type' to be indefinite."); Honeywell Int'l Inc. v. ICM Controls Corp., 45 F. Supp. 3d 969, 985 (D. Minn. 2014) ("Since the two options [for interpreting the claim] entail differing limitations for the claim, the missing language in claim 1 results in a lack of reasonable certainty as to its scope."); Light Transformation Techs. LLC v. Lighting Science Grp. Corp., et al., 12 Civ. 826 (MHS) (RSP), 2014 WL 3402125, at *9 (E.D. Tex. July 11, 2014) (finding claims indefinite where (1) the term "axis of light direction" was subject to multiple

[14] Although Plaintiff cites the use of "exhaustive search" in two Google patents (Pltf. Claim Construction Br. (Dkt. No. 148) at 18-19), the use of this term in Google's patents sheds no light on the proper construction of "non-exhaustive search" as used in Plaintiff's patents. "Exhaustive search" is used once in each of the Google patents in a highly specific context, and the term is not defined in either patent. (U.S. Patent No. 7,831,438 (Dkt. No. 148-21) col. 7-8; U.S. Patent No. 8,065,733 (Dkt. No. 148-22) col. 9) As such, the use of this term in the Google patents does not assist the Court in determining the scope of Plaintiff's asserted patents.

plausible constructions, and (2) dictionary definitions of axis contradicted plaintiff's proposed construction).

Here, the intrinsic evidence provides no definition of the term "non-exhaustive search," and the extrinsic evidence suggests that a person skilled in the art might reasonably define "non-exhaustive search" in multiple ways, including (1) Plaintiff's proposed construction (modified to remove the reference to locating a "near neighbor") – "[a] search designed to locate a [match] without comparing to all possible matches (i.e., all records in the reference data set), even if the search does not locate a [match]" (Pltf. Claim Construction Br. (Dkt. No. 148) at 14); (2) the Federal Circuit's broadest reasonable interpretation construction – "[a] search that locates a match without conducting a brute force comparison of all possible matches, and all data within all possible matches," Google Inc., 726 F. App'x at 780; and (3) Denny – "search strategies[] [that] . . . traverse the search space more or less at random and thus certain states may never be examined." (Denny (Dkt. No. 148-19) at 10)

The differences in these reasonable definitions are material to the scope of the asserted claims because different search algorithms could be considered "exhaustive" or "non-exhaustive" depending on which definition is applied. As discussed above, Dr. Mitzenmacher testified that pruning was an exhaustive search method – and it would be under Denny's definition. But pruning would not be an exhaustive search method under Plaintiff's proposed construction.

The scope of the asserted claims using the term "non-exhaustive search" is thus uncertain; a reader seeking to avoid infringement would not have the understanding necessary to be reasonably certain that a given search algorithm is exhaustive rather than non-exhaustive within the meaning of the asserted claims.

Plaintiff argues, however, that "[e]ven if the term 'non-exhaustive search' did render unasserted claim 15 indefinite[,] . . . it does not follow that dependent claim 17 is indefinite[,] [because] claim 17 narrows 'non-exhaustive search' by specifying [that] its 'non-exhaustive search' is 'sublinear.'" (Pltf. Claim Construction Reply (Dkt. No. 158) at 15) According to Plaintiff, "[b]ecause the execution time of any search that compares to all records N scales linearly with the size of the data set, a sublinear search necessarily compares to less than all records in the data set." (Id. at 16)

As an initial matter, the only case that Plaintiff cites in support of this proposition is not analogous. In Signal IP v. Am. Honda Motor Co., 2015 WL 5768344, at *34 (C.D. Cal. Apr. 17, 2015), the district court found that several claims that used the term "relative weight parameter" were indefinite, because the claims – in using the term "relative" – did not disclose the basis for comparison. Id. The court further concluded, however, that certain dependent claims that used the term "relative weight parameter" were not indefinite, because they provided "detailed embodiments of possible relative weight parameters (the total force, long term average of sensor outputs, and total load rating, respectively)." Id.

Here, dependent Claim 17 does not do this. Instead, Claim 17 introduces an additional limitation "wherein the claimed non-exhaustive search is sublinear." ('988 Patent (Dkt. No. 148-4) col. 26)

And the addition of the sublinear limitation does not clarify the definition of "non-exhaustive." Denny states that "pruning" algorithms – which, as discussed above, Denny and Dr. Mitzenmacher categorize as "exhaustive" – "can significantly reduce the required

execution time of [backtracking algorithms in general]."[15] (See Denny (Dkt. No. 148-19) at 11; see also id. (stating in chapter addressing "exhaustive construction of incidence structures" that "defining intelligent pruning heuristics to speed up the search can result in an exponential saving in the required running time")) Plaintiff's extrinsic evidence thus demonstrates that search methodologies that would qualify, under at least some definitions, as exhaustive can exhibit sublinear time and resource scaling.

In sum, the phrase "non-exhaustive search" is indefinite, because "read in light of the specification and prosecution history, [it] 'fail[s] to inform, with reasonable certainty, those skilled in the art about the scope of the invention.'" HZNP Medicines LLC v. Actavis Labs. UT, Inc., 940 F.3d 680, 688 (Fed. Cir. 2019) (quoting Nautilus, Inc. v. Biosig Instruments, Inc., 572 U.S. 898, 901 (2014)). Accordingly, the asserted claims of the '988 and '464 patent are invalid as indefinite.[16]

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[15] In their Local Rule 56.1 Statements, the parties do not dispute that, "[u]nder the parties' agreed-upon construction of the term 'sublinear,' there are examples of searches that compare to less than all of the records in a data set that scale linearly, rather than sublinearly," further suggesting that one limitation has nothing to do with the other. (See Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 109; Pltf. R. 56.1 Counterstmt. (Dkt. No. 240-61) ¶ 109 ("Undisputed."))

[16] Plaintiff argues that "there are material factual disputes" that preclude a finding that the term "non-exhaustive search" is indefinite as a matter of law. (Pltf. Claim Construction Reply (Dkt. No. 158) at 16) According to Plaintiff, the material issues of fact "includ[e] how one of skill would (1) understand the specification; (2) view the extrinsic references; and (3) more generally, understand this phrase." (Id.) Plaintiff is mistaken. The parties' disagreements about the intrinsic evidence and the meaning of a claim term are ultimately legal in nature. See Teva Pharms. USA, Inc. v. Sandoz, Inc. ("Teva II"), 789 F.3d 1335, 1342 (Fed. Cir. 2015) ("A party cannot transform into a factual matter the internal coherence and context assessment of the patent simply by having an expert offer an opinion on it. The internal coherence and context assessment of the patent [and the intrinsic evidence], and whether it conveys claim meaning with reasonable certainty, are questions of law."). Moreover, district courts are permitted to make "factual findings about extrinsic evidence relevant to the question, such as evidence about knowledge of those skilled in the art." BASF Corp. v. Johnson Matthey Inc., 875 F.3d 1360, 1365 (Fed. Cir. 2017); see also Teva I, 574 U.S. at 332 (noting in the context of a dispute

2. "Correlation Information"[17]

Claim Term	Plaintiff's Construction	Defendants' Construction
"correlation information"	Ordinary meaning. Alternatively: "information that associates the first electronic media work with an electronic media work identifier"	Indefinite.

(Am. Jt. Claim Construction Chart (Dkt. No. 146) at 3)

As an initial matter, Plaintiff argues that the Court need not construe the term "correlation information" because the "ordinary meaning of this term would have been clear to not only persons of skill in the art, but also to lay persons reading the claims." (Pltf. Claim Construction Br. Dkt. (No. 148) at 23-24) "'In some cases, the ordinary meaning of claim language . . . may be readily apparent even to lay judges, and claim construction in such cases involves little more than the application of the widely accepted meaning of commonly understood words.'" O2 Micro Int'l Ltd. v. Beyond Innovation Tech. Co., 521 F.3d 1351, 1360 (Fed. Cir. 2008) (quoting Phillips, 415 F.3d at 1312-13 (Fed.Cir.2005)). "However, in many

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regarding indefiniteness that "[i]n cases where those subsidiary facts are in dispute, courts will need to make subsidiary factual findings about that extrinsic evidence."); see also Teva II, 789 F.3d at 1339 ("If a district court needs to consult extrinsic evidence, for example, to understand the meaning of a term in the relevant art at the relevant time, the court may need to make subsidiary factual findings about that extrinsic evidence.").

Here, this Court has determined that the extrinsic evidence demonstrates that the term "non-exhaustive search" has multiple possible meanings such that a person skilled in the art could not be reasonably certain as to the scope of the asserted claims. This conclusion flowed from the evidence that Plaintiff proffered, without regard to competing evidence. Plaintiff's citation to pre-Teva case law for the proposition that the submission of extrinsic evidence creates an issue of fact for the jury is unpersuasive. See Rembrandt Data Techs., LP v. AOL, LLC, 641 F.3d 1331, 1335 (Fed. Cir. 2011) (affirming district court's finding of indefiniteness as to eight claims).

[17] This term appears only in the '464 Patent. Although the Court has concluded that all of the asserted claims of the '464 Patent are invalid as indefinite, in the interest of completeness, the Court considers below whether this term is likewise indefinite.

cases, the meaning of a claim term as understood by persons of skill in the art is not readily apparent." Id.

For example, in O2 Micro, the Federal Circuit concluded that the district court had erred in not construing the term "only if." While this phrase has a "well understood definition" amongst lay people, the parties had "presented a dispute to the district court regarding the scope of [that claim term]," and the district court – in failing to construe the term – had not resolved the dispute. Id. ("[T]he parties agreed that 'only if' has a common meaning, but then proceeded to dispute the scope of that claim term.").

"Correlation information," unlike "only if," is not a phrase that has a "well understood definition." See id. And contrary to Plaintiff's argument, it matters not that "correlation" and "information" are each well understood words. (See Pltf. Claim Construction Br. (Dkt. No. 148) at 24 (citing dictionary definitions); see also O2 Micro, 521 F.3d at 1361 ("In deciding that '"only if" needs no construction' because the term has a 'well-understood definition,' the district court failed to resolve the parties' dispute because the parties disputed not the meaning of the words themselves, but the scope that should be encompassed by this claim language.").

Here, as in O2 Micro, the parties have presented a dispute as to claim scope. As discussed above, Plaintiff argues for ordinary meaning or, failing that, the following construction: "information that associates the first electronic media work with an electronic media work identifier." (Am. Jt. Claim Construction Chart (Dkt. No. 146) at 3) Defendants argue that the claim term is indefinite (id.), i.e., that "correlation information" fails to "inform those skilled in the art about the scope of the invention with reasonable certainty." Nautilus, 572 U.S. at 910. Accordingly, the Court must construe the claim term. See O2 Micro, 521 F.3d at

1360 ("When the parties raise an actual dispute regarding the proper scope of these claims, the court . . . must resolve that dispute.").

In arguing that this Court should construe "correlation information" to mean "information that associates the first electronic media work with an electronic media work identifier" (Pltf. Claim Construction Br. (Dkt. No. 148) at 24-25), Plaintiff contends that this definition "is rooted in the claim language itself," in that the '464 patent "states that the 'correlation information associat[es] the first electronic media work and the electronic media work identifier.'" (Id. at 25 (alteration in original))

Defendants counter that the term is indefinite because there is a "complete absence of intrinsic evidence" as to the meaning of "correlation information." (Def. Claim Construction Br. (Dkt. No. 151) at 23-25; id. (arguing that the term "correlation information" does not appear in the specification and that the patent "does not describe the creation or 'storing' of 'correlation information' at all")) Defendants further argue that reference to the preceding element of the asserting claims

> only raises more questions about the scope of the claims. Does the "correlation information" referenced in the next element consist of whichever data is created by "correlating" the "electronic media work" and the "identifier"? Or must the "correlation information" be distinct from the byproducts of the "correlating" step, given that the "storing" step was drafted as a separate element of the claims? Relatedly, does the "correlation information" need to be represented by a distinct and identifiable entry in a database, such as an alphanumeric code indicating that an unknown "electronic media work" has been "correlated" with an "identifier"? And, if not, how and where is the "correlation information" stored?

(Id. at 24-25)

As an initial matter, Defendants err in asserting that there is a "complete absence of intrinsic evidence" (id. at 23), because a patent's claims are a critical component of intrinsic evidence. Immunex Corp. v. Sanofi-Aventis U.S. LLC, 977 F.3d 1212, 1218 (Fed. Cir. 2020) ("When construing claim terms, we first look to, and primarily rely on, the intrinsic evidence,

including the claims themselves. . . .'" (quoting Personalized Media Commc'ns, LLC v. Apple Inc., 952 F.3d 1336, 1340 (Fed. Cir. 2020))).

Moreover, the questions posed by Defendants merely reflect an effort to inject uncertainty where none exists on the face of the '464 Patent. "'Mathematical precision'" is not required to avoid invalidation. See Interval Licensing, 766 F.3d at 1370 (quoting Invitrogen Corp. v. Biocrest Mfg., L.P., 424 F.3d 1374, 1384 (Fed.Cir. 2005)). Because the second element provides that an electronic media work must be "correlate[d]" with an electronic media work identifier, it follows logically that the "correlation information" is information that was generated by the previous step. ('464 Patent (Dkt. No. 148-6) col. 24-26) Moreover, the language that immediately follows instructs that the information to be stored "associat[es] the first electronic media work and the electronic media work identifier." (Id. col. 24-25)

Defendants have not responded to Plaintiff's argument that the clause immediately following "correlation information" defines the term. (See Def. Claim Construction Br. (Dkt. No. 151); Def. Claim Construction Sur-Reply (Dkt. No. 163)) The patent clearly teaches that after the two works are correlated, the information "associating the first electronic media work and the electronic media work identifier" should be stored, and the claim refers to that information as "correlation information." ('464 Patent (Dkt. No. 146-6) col. 24-26)

In sum, Defendants have not demonstrated that the term "correlation information" is indefinite. The Court adopts Plaintiff's proposed construction.

3. "Extracting Features" and "Extracted Features"[18]

Claim Term	Plaintiff's Construction	Defendants' Construction
"Extracted features"	"Electronic data **sampled, calculated, or otherwise** derived from a work itself, as opposed to from information added or appended to the work."	"Electronic data derived from a work itself, as opposed to from information added or appended to the work."
"Extracting features"	"**Sampling, calculating, or otherwise** deriving electronic data from a work itself, as opposed to from information added or appended to the work."	"Deriving electronic data from a work itself, as opposed to from information added or appended to the work."

(Am. Jt. Claim Construction Chart (Dkt. No. 146) at 3 (emphasis added))

The disputed terms appear in the following independent claims:

15. A method for associating an electronic work with an action, the electronic work comprising at least one of audio and video, the method comprising:

a) electronically extracting features from the electronic work;

b) electronically determining an identification of the electronic work based on the extracted features, wherein the identification is based on a non-exhaustive search identifying a neighbor;

c) electronically determining an action based on the identification of the electronic work; and

d) electronically performing the action.

('988 Patent (Dkt. No. 148-4) col. 26)

33. A computer-implemented method comprising:

a) obtaining, by a computer system including at least one computer, media work extracted features that were extracted from a media work, the media work uploaded from a client device;

b) determining, by the computer system, an identification of the media work using the media work extracted features to perform a sublinear approximate nearest neighbor search of reference extracted features of reference identified media works; and

c) determining, by the computer system, an action based on the determined identification of the media work.

[18] "Extracted features" appears in the '988 patent and the '237 patent. "Extracting features" appears in the '988 Patent. Although the Court has concluded that the asserted claims of the '988 Patent are invalid as indefinite, in the interest of completeness, the Court considers below whether these terms are likewise indefinite.

('237 Patent (Dkt. No. 148-5) col. 28)

At an earlier point in this litigation, the parties agreed to the construction of "extracted features" that Defendants propose now: "[e]lectronic data derived from a work itself, as opposed to from information added or appended to the work." (See Jt. Claim Construction Chart (Dkt. No. 53) at 2)

Plaintiff now argues, however, that "it became clear from discovery . . . that the parties have differing views on the scope of 'derived' in the context of 'extracted features' and 'extracting features,'" and that Plaintiff's new proposed construction clarifies "how the 'features' are 'extracted' from a work using computer technology." (Pltf. Claim Construction Br. (Dkt. No. 148) at 25-26 (emphasis in original))

Defendants complain that Plaintiff seeks to renege on the agreed-upon constructions "to broaden the meaning of a claim term after it has engaged in extensive discovery regarding Defendants' Content ID system, out of fear that, under the originally agreed construction, Defendants' Content ID system does not infringe." (Def. Claim Construction Br. (Dkt. No. 151) at 26) According to Defendants, "there is no basis in the specification for regarding 'calculating' as an example of 'extracting' a feature or 'deriving electronic data from a work.'" (Id. at 27 (emphases omitted))

Plaintiff maintains that its proposed construction is consistent with the following language from the '988 Patent's specification, which explains that feature extraction operations derive a representation of the work by, for example, sampling the work or performing a calculation:

> "The purpose of the feature extraction operation is to **derive** a compact electronic representation of the work that can subsequently be used for the purpose of recognition. In the case of images and video, this feature vector might be a pseudo-random **sample** of pixels from the frame or a low-resolution copy of the frame or the average intensities of n×n blocks of pixels. It might also be a

> frequency-based decomposition of the signal, such as produced by the **Fourier, wavelet and or discrete cosine transforms**. It might involve **principal component analysis**. It might also be a combination of these. For television and audio signals, recognition might also rely on a temporal sequence of feature vectors. The recognition literature contains many different representations. For block-based methods, blocks may be accessed at pseudo-random locations in each frame or might have a specific structure. For audio, common feature vectors are based on Fourier frequency decompositions, but other representations are possible."

(Pltf. Claim Construction Br. (Dkt. No. 148) at 26 (quoting '988 Patent (Dkt. No. 148-4) col. 7) (emphasis in Plaintiff's brief); see also '237 Patent (Dkt. No. 148-5) col. 19-20 (containing substantively identical language))

According to Plaintiff, its "proposed constructions make clear for the fact-finder that the sampling actions and mathematical calculations, as disclosed in the specification, are ways in which an electronic representation can be derived from a media work itself." (Pltf. Claim Construction Br. (Dkt. No. 148) at 27)

Defendants counter that the "previously agreed-upon construction is firmly rooted in the specifications, which state that '[t]he purpose of the feature extraction process is to derive a compact representation of the work that can subsequently be used for the purpose of recognition.'" (Def. Claim Construction Br. (Dkt. No. 151) at 26 (quoting '988 Patent (Dkt. No. 148-4) col. 7) (emphasis omitted)) Defendants maintain that "countless examples of 'calculations'. . . would not create an 'extracted feature' in the eyes of a person of skill in the art." (Id. at 27) Although calculations are sometimes part of the extraction operation process, the noteworthy aspect of these operations is not the calculations themselves but the process of deriving information from the work. (Id.)

As an initial matter, the specification excerpts set forth above clearly contemplate that the extracting features process may require sampling from a media work. Indeed, the specification provides as an example a "pseudo-random sample of pixels from the frame" of a

video uploaded to YouTube. ('237 Patent (Dkt. No. 148-5) col. 19-20) It is likewise clear even to a lay person that "sampling" is a method for "extracting" features from a work. A pixel that is "sampled" from a video frame is also "extracted" from that frame. Defendants do not offer any argument as to why the inclusion of the term "sampling" is overbroad in light of the intrinsic or extrinsic evidence. Accordingly, the Court concludes that its inclusion in the construction is appropriate.

While the specification does not use the word "calculate," it discloses other "feature extraction operation[s]," including "Fourier, wavelet and or discrete cosine transforms" and "principal component analysis." (Id. col. 6) As to whether these operations constitute "calculations," Plaintiff's expert – Dr. Mitzenmacher – offers the following in his declaration:

> A person of skill in the art would have understood that both Fourier, wavelet, and discrete cosine transforms/decompositions and principal component analyses are types of mathematical operations or calculations that can be performed on an electronic work to extract features from it to create a "sketch" or "fingerprint" of the work. Each of these calculations uses computer technology to create a simplified electronic representation of the media work at issue, and do so using data from the work itself.
>
> . . . .
>
> The above computational methods share roughly the same basic framework in terms of generating "sketches" or "fingerprints" of an electronic work such as an audio or video file. These methods involve taking large multi-dimensional data and, using computer technology, transforming that data into a different representation so that the most important aspects of the data correspond to values for a small number of dimensions; these numbers correspond to the sketch or fingerprint. As an example, for images, the discrete cosine transform described in the specification is used in the well-known JPEG compression algorithm. The JPEG compression algorithm takes 8 by 8 blocks of pixels, which can be represented as 64 color values (one for each pixel), and transforms them into another collection of 64 values that represent the same block of pixels in a different, more compact way that conveys the critical information about the file.

(Mitzenmacher Decl. (Dkt. No. 148-1) ¶¶ 64-65 (footnote omitted))

In response, Defendants have submitted a declaration from Dr. James Storer, Professor of Computer Science at Brandeis University. (Storer Decl. (Dkt. No. 152)) Dr. Storer states that these paragraphs of the Mitzenmacher declaration demonstrate that

> the defining characteristic of "extracting features" is not that it entails "sampling or "calculating" from a work. Rather, the process of "extracting features" is defined by the way in which it entails "creat[ing] a simplified electronic representation of the media work at issue . . . using data from the work itself," such "that the most important aspects of the data correspond to values for a small number of dimensions."

(Id. ¶ 131 (quoting Mitzenmacher Decl. (Dkt. No. 148-1) ¶¶ 64-65) (alteration in original))

But Dr. Storer's response does not explain how the addition of the word "calculation" broadens the scope of the claim, or why Dr. Mitzenmacher's explanation of how a calculation can be used to extract features from a media work is incorrect. Nor does Dr. Storer's declaration address Dr. Mitzenmacher's opinion that the specification explicitly contemplates the utilization of "calculations" in order to extract features from a media work.

The Court concludes that Defendants have not rebutted Plaintiff's extrinsic evidence that "extracting features" can include "calculating . . . electronic data from a work" (Am. Jt. Claim Construction Chart (Dkt. No. 146) at 3), and finds no merit in Defendants' argument that there "is no support in the patents or Network-1's own declaration for its proposed broadening of the construction of 'extracting features' and 'extracted features.'" (See Def. Claim Construction Br. (Dkt. No. 151) at 28)

Indeed, Defendants implicitly concede that "calculating" may be a method for extracting features. (See Def. Claim Construction Br. (Dkt. No. 151) at 27 ("[E]very operation performed by a computer entails performing a variety of calculations.") (internal quotation marks omitted)) Defendants argue, however, that "[t]here are countless examples of 'calculations' that could be performed 'on data comprising a work' that would not create an 'extracted feature' in

the eyes of a person of skill in the art." (Id.) For example, "a computer might perform 'calculations on data comprising a work' by (1) determining the number of bits in an image file and (2) multiplying by zero." (Id.) Acknowledging that this hypothetical calculation would both be meaningless and not represent extracted features – because any number multiplied by zero would sum to zero – Defendants' example is not sufficient to rebut the intrinsic and extrinsic evidence demonstrating that the feature extraction process detailed in the specification contemplates "calculations." Moreover, Plaintiff's proposed construction provides that extracted features are "sampled, calculated, or otherwise derived" from the underlying media work. (Pltf. Claim Construction Reply (Dkt. No. 158) at 18 (emphasis in original)) This language ties the "sample" or "calculation" to the underlying work.

The Court concludes that Plaintiff's proposed construction of "extracted features" and "extracting features" is consistent with the intrinsic and extrinsic evidence. Accordingly, the Court adopts Plaintiff's proposed construction.

II. SUMMARY JUDGMENT

Having concluded that the asserted claims of the '988 and '464 Patents are invalid as indefinite, the Court considers whether Defendants are entitled to summary judgment on Plaintiff's claims of infringement as to the '237 Patent.

A. Legal Standards

1. Summary Judgment

Summary judgment is warranted where the moving party "shows that there is no genuine dispute as to any material fact" and that it "is entitled to judgment as a matter of law." Fed. R. Civ. P. 56(a). "A dispute about a 'genuine issue' exists for summary judgment purposes where the evidence is such that a reasonable jury could decide in the non-movant's favor." Beyer v. Cnty. of Nassau, 524 F.3d 160, 163 (2d Cir. 2008) (quoting Guilbert v. Gardner, 480

F.3d 140, 145 (2d Cir. 2007)). "When no rational jury could find in favor of the nonmoving party because the evidence to support its case is so slight, there is no genuine issue of material fact and a grant of summary judgment is proper." Gallo v. Prudential Residential Servs., Ltd. P'ship, 22 F.3d 1219, 1224 (2d Cir. 1994) (citing Dister v. Cont'l Grp., Inc., 859 F.2d 1108, 1114 (2d Cir. 1988)). "'[T]hat opposing parties assert competing versions of the same event is not in itself sufficient to preclude summary judgment,' in that contradictory testimony only establishes a 'genuine' issue for trial if it 'lead[s] to a different legal outcome.'" Yi Fu Chen v. Spring Tailor, L.L.C., No. 14 Civ. 218 (PAE), 2015 WL 3953532, at *4 (S.D.N.Y. June 29, 2015) (alterations in original) (quoting Krynski v. Chase, 707 F. Supp. 2d 318, 322 (E.D.N.Y. 2009)).

In deciding a summary judgment motion, the Court "'resolve[s] all ambiguities, and credit[s] all factual inferences that could rationally be drawn, in favor of the party opposing summary judgment.'" Spinelli v. City of New York, 579 F.3d 160, 166 (2d Cir. 2009) (quoting Brown v. Henderson, 257 F.3d 246, 251 (2d Cir. 2001)). However, "'[a] party may not rely on mere speculation or conjecture as to the true nature of the facts to overcome a motion for summary judgment. . . . [M]ere conclusory allegations or denials . . . cannot by themselves create a genuine issue of material fact where none would otherwise exist.'" Hicks v. Baines, 593 F.3d 159, 166 (2d Cir. 2010) (second alteration and omissions in original) (quoting Fletcher v. Atex, Inc., 68 F.3d 1451, 1456 (2d Cir. 1995)). Moreover, "'[t]he principles governing admissibility of evidence do not change on a motion for summary judgment[,]' and district courts need only consider admissible evidence in ruling on a motion for summary judgment." I.M. v. United States, 362 F. Supp. 3d 161, 174 n.9 (S.D.N.Y. 2019) (quoting Raskin v. Wyatt Co., 125 F.3d 55, 66 (2d Cir. 1997)).

"'Where, as here, the burden of persuasion at trial would be on the non-moving party[,] . . . the party moving for summary judgment may satisfy [its] burden of production under Rule 56 in either of two ways: (1) by submitting evidence that negates an essential element of the non-moving party's claim, or (2) by demonstrating that the non-moving party's evidence is insufficient to establish an essential element of the non-moving party's claim.'" Nick's Garage, Inc. v. Progressive Cas. Ins. Co., 875 F.3d 107, 114 (2d Cir. 2017) (quoting Farid v. Smith, 850 F.2d 917, 924 (2d Cir. 1988)).

2. Patent Infringement

While a patent "[i]nfringement [claim presents] a question of fact," Apple Inc. v. Samsung Elecs. Co., 839 F.3d 1034, 1040 (Fed. Cir. 2016), "a court may grant summary judgment if it concludes that no reasonable jury could find infringement." Kewazinga Corp. v. Microsoft Corp., 558 F. Supp. 3d 90, 102 (S.D.N.Y. 2021), reconsideration denied, 2022 WL 4236301 (S.D.N.Y. Sept. 14, 2022). "The infringement analysis 'entails two steps,' the first of which is construing the claims, and the second of which 'is comparing the properly construed claims to the' accused products." Philip Morris Prod. S.A. v. Int'l Trade Comm'n, 63 F.4th 1328, 1348 (Fed. Cir. 2023) (quoting Duncan Parking Techs., Inc. v. IPS Grp., Inc., 914 F.3d 1347, 1360 (Fed. Cir. 2019)). "To prove literal infringement, the patentee must show that the accused device contains each and every limitation of the asserted claims." Ericsson, Inc. v. D-Link Systems, Inc., 773 F.3d 1201, 1215 (Fed. Cir. 2014) (emphasis omitted). "For infringement, [Network-1] as the patentee has the burden of persuasion." SIMO Holdings Inc. v. Hong Kong Cloudlink Network Tech. Ltd., 983 F.3d 1367, 1380–81 (Fed. Cir. 2021); Medtronic, Inc. v. Mirowski Family Ventures, LLC, 571 U.S. 191, 198-99, (2014) ("[T]he burden of persuasion is with the patentee . . . [in] an infringement suit.").

"[A] party may not avoid summary judgment simply by offering an opinion of an expert that states, in effect, that the critical claim limitation is found in the accused device." Arthur A. Collins, Inc. v. N. Telecom Ltd., 216 F.3d 1042, 1047 (Fed. Cir. 2000). Rather, "[t]o satisfy the summary judgment standard, a patentee's expert must set forth the factual foundation for his infringement opinion in sufficient detail for the court to be certain that features of the accused product would support a finding of infringement[,] . . . with all reasonable inferences drawn in favor of the non-movant." Intellectual Sci. & Technology, Inc. v. Sony Elecs., Inc., 589 F.3d 1179, 1183 (Fed. Cir. 2009); see also SIMO Holdings, 983 F.3d at 1380-81 (same; applying Second Circuit procedural law); Garcia v. Hartford Police Dep't, 706 F.3d 120, 128 (2d Cir. 2013) (expert reports containing "speculative or conclusory" assertions are "inappropriate for consideration on summary judgment"; to defeat summary judgment, an expert report must "add . . . facts to the record that create a genuine dispute as to any material fact" (emphasis omitted)).

B. Analysis

The parties do not dispute how the LSH and Siberia systems function. (See Pltf. R. 56.1 Counterstmt. (Dkt. No. 240-61) ¶¶ 28-68) Instead, the parties' dispute centers on whether those systems meet the limitations of step b of claim 33 of the '237 Patent.

Claim 33 of the '237 Patent concerns:

> A computer-implemented method comprising:
>
> a) obtaining, by a computer system including at least one computer, media work extracted features that were extracted from a media work, the media work uploaded from a client device;
>
> b) determining, by the computer system, an identification of the media work using the media work extracted features to perform a sublinear approximate nearest neighbor search of reference extracted features of reference identified media works; and

> c) determining, by the computer system, an action based on the determined identification of the media work.

('237 Patent (Dkt. No. 148-5) col. 28)

Google claims that it is entitled to summary judgment on Plaintiff's infringement claim because "neither [the LSH nor the Siberia] version of Google's Content ID system performs [a] 'sublinear' search," and accordingly that limitation of Claim 33 is not met. (Def. Sum. J. Br. (Dkt. No. 224) at 21) Google further argues that – to the extent that a portion of either version of its Content ID system meets the sublinear limitation of the '237 Patent – Plaintiff has not offered evidence that either version of Content ID as a whole performs a search that is at once (1) "sublinear"; (2) an "approximate nearest neighbor search"; and (3) of "reference extracted features." (See id. at 30-37)

As to the construction of "'sublinear' [search]," the parties agree that it "is [a] search whose execution time scales with a less than linear relationship to the size of the data set to be searched, assuming computing power is held constant." (Am. Jt. Claim Construction Stmt. (Dkt. No. 146) at 2) The parties further agree that "a search whose execution time scales proportionately with the size of the data set to be searched scales linearly, rather than sublinearly." (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 111; Pltf. R. 56.1 Counterstmt. (Dkt. No. 240-61) ¶ 111); see also Linear, McGraw-Hill Dictionary of Scientific and Technical Terms (6th ed. 2003) ("[Linear][:] . . . Having an output that varies in proportion to the input."). Accordingly, the accused versions of Google's Content ID system meet the sublinear limitation if the execution time of the searches they perform scales in a less than proportional relationship to the size of the reference set.

1. Whether the LSH Version of Content ID Performs a Sublinear Search

Defendants say that "whenever a new reference was added to the LSH index, the LSH bands associated with that video were populated in the index," such that each new reference constituted a new "potential match." (Def. Sum. J. Br. (Dkt. No. 224) at 27) As a result, the LSH version is not sublinear. (Id. at 26-27) According to Defendants, "Network-1 has not presented any argument or evidence that the number of matches scales in a way that is less than proportional to the number of references to be searched." (Id. at 28 (emphasis omitted)) Google further argues that Dr. Mitzenmacher's report and testimony demonstrate that "the number of matches is a function of the number of references to be searched because each reference is associated with some of the existing finite set of LSH bands." (Id. (emphasis omitted)) "Dr. Mitzenmacher's statement that the LSH lookup returns its results 'in time proportional to the number of matches' is no different from the observation that it returns its results in time proportional to the number of references to be searched." (Id. (quoting Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 211) (emphasis omitted)) Finally, Google argues that Network-1's other evidence "consists of isolated uses of [the] term ['sublinear'] by a Google witness and in Google documents that are uninformed by the parties' agreed construction[,] and thus do[es] not shed light on whether the LSH version is 'sublinear' under the meaning of that term in this case." (Id. at 29)

While the Court does not agree with Defendants' observation that Dr. Mitzenmacher's report and testimony "lead[] to the ineluctable conclusion that the LSH version of the Content ID system did not meet the 'sublinear' limitation" (see Def. Sum. J. Br. (Dkt. No. 224) at 27), for the reasons explained below, the Court concludes that Network-1 has not presented evidence sufficient to create a material issue of fact as to whether the LSH version of

Content ID meets the "sublinear" limitation in claim 17 of the '988 Patent and claim 33 of the '237 Patent.

In opposing Defendants' summary judgment motion, Plaintiff cites the following evidence: (1) Dr. Mitzenmacher's report and testimony; (2) a Google 2010 draft document describing a potential update to the Content ID system; and (3) the academic work and testimony of Google research scientist Dr. Shumeet Baluja. (See Pltf. Sum. J. Opp. (Dkt. No. 240) at 7-12)

a. The Mitzenmacher Report

The Mitzenmacher Report's analysis of whether the LSH version of Content ID performed a sublinear search is quite sparse. Omitting references, the entirety of the analysis is as follows:

> 209. The approximate nearest neighbor (or neighbor or near neighbor) search of the Content ID LSH Version is sublinear.
>
> 210. Starting from the first step, the Content ID LSH Version system is designed to determine a very small subset of the reference works in the database, in particular a sublinear subset, that could be possible matches to the input work being queried. This is through the creation of what is commonly referred to as an "inverted index data structure, based on LSH bands: only reference works that match in terms of the LSH bands are subject to further analysis.
>
> 211. The inverted index is designed to be a sublinear data structure; that is, the inverted index on a query. Rather in this setting, when given an LSH band, the inverted index can directly return a list of the reference works that match that LSH band, in time proportional to the number of matches. Hence the work done by the inverted index corresponds to the number of index hits, not the number of references. This is a general property of inverted indexes.
>
> 212. Review of source code produced by the Defendants in this case confirms my analysis of this claim element . . . [description of Content ID Source Code]
>
> 213. It is my opinion that the Content ID LSH Version meets claim element 33b) literally. . . .

(Mitzenmacher Rpt. (Dkt. No. 226-6) ¶¶ 209-13 (addressing Claim 33 of the '237 Patent); see also id. ¶¶ 144-47 (Claim 17 of the '988 Patent))

These paragraphs do not state that the LSH version of Content ID, by virtue of its "inverted index" structure, performed a "search whose execution time scales with a less than linear relationship to the size of the data set to be searched, assuming computing power is held constant." (Am. Jt. Claim Construction Stmt. (Dkt. No. 246) at 2) Rather, Dr. Mitzenmacher contends that the LSH version was an "inverted index[,] designed to be a sublinear data structure," and to "determine a very small subset of the reference works in the database, in particular a sublinear subset." (Mitzenmacher Rpt. (Dkt. No. 226-6) ¶¶ 210-211) But the asserted claims require that the LSH version of Content ID perform a sublinear search, not that it "determine" a "sublinear subset" of the total reference works. Indeed, the "sublinear" claim limitation construed by the parties specifically references a "search." (See Am. Jt. Claim Construction Stmt. (Dkt. No. 146) at 2 (reflecting parties' agreed construction that a "'sublinear search' is [a] search whose execution time scales with a less than linear relationship to the size of the data set to be searched, assuming computing power is held constant")) Dr. Mitzenmacher does not explain in his report or in his testimony what he means in positing a "sublinear subset [of data]."

In any event, to the extent that the Mitzenmacher Report can be read as stating that the LSH version of Content ID performed a sublinear search, any such assertion is – as discussed below – conclusory and lacks an adequate factual basis. See Intellectual Sci. & Technology, Inc., 589 F.3d at 1183 ("To satisfy the summary judgment standard, a patentee's expert must set forth the factual foundation for his infringement opinion in sufficient detail for the court to be certain that features of the accused product would support a finding of infringement[,] . . . with all reasonable inferences drawn in favor of the non-movant.").

According to Dr. Mitzenmacher, the LSH version of Content ID is structured as an "inverted index." For this proposition, Dr. Mitzenmacher relies on a draft document produced in discovery by Google. (Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 210 (citing Pltf. Ex. 40 (Dkt. No. 240-15) at 3 [redacted] As discussed below, this document is a draft from 2010 that does not purport to describe the LSH version of Content ID that Google ultimately implemented. Even assuming arguendo that the accused LSH version of Content ID is structured as an inverted index, that characteristic does not explain what a "sublinear subset" of a dataset is, nor does it demonstrate that the LSH version of Content ID necessarily performed a sublinear search.

In asserting – in Paragraph 211 of his report – that an "inverted index is designed to be a sublinear data structure," and that it "is a general property of inverted indexes" that "the work done by the inverted index corresponds to the number of index hits, not the number of references," Dr. Mitzenmacher cites only to a Wikipedia entry. (See Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 211)

The Wikipedia entry states that

> an inverted index . . . is a database index storing a mapping from content, such as words or numbers, to its locations in a table, or in a document or a set of documents (named in contrast to a forward index, which maps from documents to content). . . .
>
> The inverted index data structure is a central component of a typical search engine indexing algorithm. A goal of a search engine implementation is to optimize the speed of the query: find the documents where word X occurs. Once a forward index is developed, which stores lists of words per document, it is next inverted to develop an inverted index. Querying the forward index would require sequential iteration through each document and to each word to verify a matching document. The time, memory, and processing resources to perform such a query are not always technically realistic. Instead of listing the words per document in the forward index, the inverted index data structure is developed which lists the documents per word.

> With the inverted index created, the query can be resolved by jumping to the word ID (via random access) in the inverted index.

Inverted Index, Wikipedia.org, https://en.wikipedia.org/wiki/Inverted_index (last visited Apr. 23, 2024).

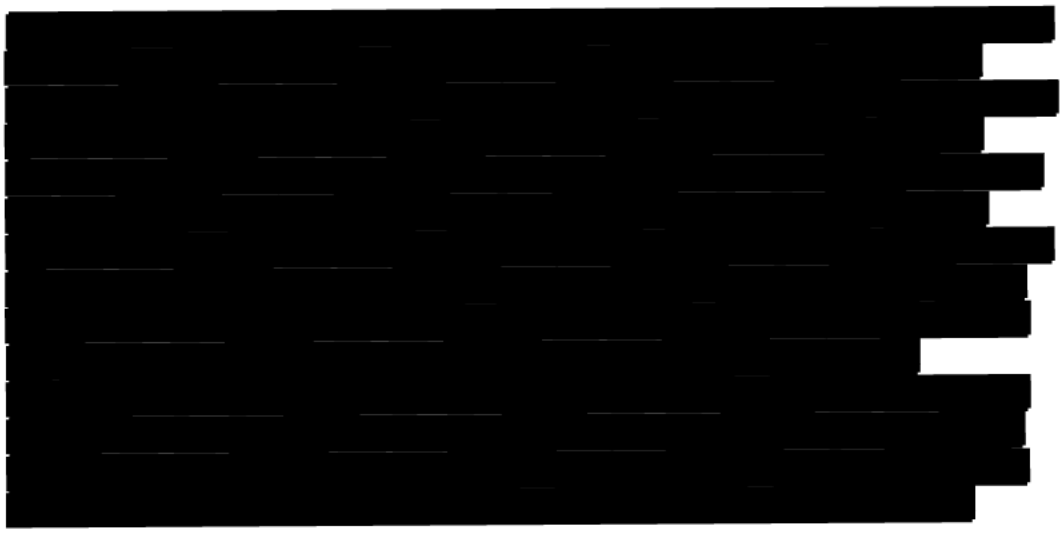
Accepting the Wikipedia entry's representation that the use of inverted indices is far more efficient in terms of "time, memory, and processing resources" than the use of forward indices for word queries, see id., it does not follow that as the size of the reference set increases, the number of index hits – and thus resources expended on a search of the index – does not also grow proportionally. Indeed, the Wikipedia entry states that inverted indices are designed to "allow fast full-text searches, at a cost of increased processing when a document is added to the database." Id. The Wikipedia entry thus acknowledges that – as the size of the reference set increases – the number of index hits, and the resources expended on a search of the index, will likewise increase. And nothing in the Wikipedia entry suggests that the resources expended will grow at anything less than a linear rate. See id. Finally, the Wikipedia entry does not use the terms "sublinear search" or "sublinear subset." See id.

Plaintiff has conflated the resource efficiency of a search with the scaling of resource costs as a dataset grows. The Wikipedia entry tells us that a query directed to an inverted index structure – such as that allegedly employed in the LSH system – is more efficient (in terms of time and computing resources) at retrieving matches than a query directed to a forward index. But the Wikipedia entry tells us nothing about whether a search of an inverted index is "sublinear" under the parties' agreed upon construction.

Consider the following: assume that a search of an inverted index with 5 million reference records takes 5 minutes. Further assume that computing power is held constant. Does a search of the same index with 10 million records take 10 minutes, and thus scaling linearly, or

does the search of the 10 million records take between 5 and 9 minutes, thus scaling sublinearly? The fact that a search of a traditional forward index containing 5 million records might take five hours instead of five minutes is irrelevant to this question. And "[u]nder the parties' agreed-upon construction of the term 'sublinear,' a search can scale linearly, rather than sublinearly, even if it 'is designed to determine a very small subset of the reference works in the database.'" (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 110 (quoting Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 210); Pltf. R. 56.1 Counterstmt. (Dkt. No. 240-61) ¶ 110) In short, the Wikipedia entry cited in the Mitzenmacher Report does not support Plaintiff's assertion that the LSH version of Content ID meets the sublinear limitation.

As to Dr. Mitzenmacher's assertion in paragraph 212 that his "review of [Google's] source code . . . confirm[ed]" his view that the LSH version of Content ID meets the sublinear limitation, Dr. Mitzenmacher's assertion is devoid of analysis. (Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 212) He merely describes the steps the source code takes to complete a search, listing out each function as it is called. As to Stage I of the search – the LSH index lookup portion of the LSH version on which the Mitzenmacher Report focuses – Dr. Mitzenmacher states only that



(Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 212) Nothing in this recitation suggests that the LSH version of Content ID performed a "search whose execution time scales with a less than linear relationship to the size of the data set to be searched, assuming computing power is held constant." (Am. Jt. Claim Construction Stmt. (Dkt. No. 246) at 2)

Plaintiff argues, however, that Dr. Mitzenmacher explained at deposition that "it logically follows from [his discussion of source code in the Mitzenmacher Report] . . . that the number of matches scales in a sublinear (and not in a proportional or linear) fashion as the number of references to be searched increases." (Pltf. Sum. J. Opp. (Dkt. No. 240) at 9) Plaintiff cites the following testimony in support of this assertion:

> Q. So just explain to me what you mean – what does it mean to say that the Content ID LSH version system determines a sublinear subset [of matches]?
>
> A. So I think the point is that the work going in to like the number of things in the subset were sublinearly with the corresponding work or execution time to handle such objects, while also grow sublinearly in the setting of the context of claim construction.

(Id. (quoting Mitzenmacher Dep. (Dkt. No. 240-9) at 169) This gibberish does not clarify anything in the Mitzenmacher Report, nor does it provide a factual basis for concluding that the LSH version of Content ID meets the sublinear limitation.

In sum, nothing in the Mitzenmacher Report, in Dr. Mitzenmacher's testimony, or in the record as a whole would permit a reasonable jury to conclude that the LSH version of

Content ID performed the required sublinear search.[19] See Arthur A. Collins, Inc., 216 F.3d at 1047 ("[A] party may not avoid summary judgment simply by offering an opinion of an expert that states, in effect, that the critical claim limitation is found in the accused device. . . . [T]he affidavit of an expert submitted in opposition to a motion for summary judgment must do more by 'set[ting] forth specific facts showing that there is a genuine issue for trial.'") (quoting Celotex Corp. v. Catrett, 477 U.S. 317, 323, 325 (1986)).

b. The CoverCat Draft

In opposing Defendants' summary judgment motion, Network-1 also cites a January 5, 2010 Google "draft" document entitled [redacted]

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[19] Plaintiff argues that the varying testimony of the parties' experts presents a material issue of fact. In this regard, Plaintiff notes that Defendants' expert, Dr. Samrat Bhattacharjee, opines that "'[t]he search performed by the LSH Version of the Content ID system is not sublinear because the system searches the LSH index [redacted]" (Pltf. Sum. J. Opp. (Dkt. No. 240) at 10 (quoting Bhattacharjee Decl. (Dkt. No. 240-59) ¶ 290)), while Dr. Mitzenmacher testified that the LSH version's [redacted]. (Id. at 11) Testimony from David Erb – the "tech lead and manager of Content ID" since December 2011 – confirms that Dr. Mitzenmacher's understanding is correct. See Erb Dep. (Dkt. No. 240-3) at 77 ("The BigTable is actually a sparse key value store, meaning that the only columns that actually exist for that row are the ones that have content in them. And the content of each column . . . [is the reference] video ID.")

For purposes of their summary judgment motion, Defendants do not dispute Plaintiff's assertion that "[a] search of the LSH index using a particular LSH band [redacted]." (Pltf. R. 56.1 Counterstmt (Dkt. No. 240-61) ¶¶ 159-62; Def. Reply R. 56.1 Stmt. (Dkt. No. 232) ¶¶ 159-62 ("Undisputed . . . .")) The fact that a search of the LSH index [redacted] does not necessarily mean that a search of the index is sublinear as that term has been construed by the parties, however. (See Def. R. 56.1 Stmt. Dkt. No. 225) ¶ 109 ("Under the parties' agreed-upon construction of the term 'sublinear,' there are examples of searches that compare to less than all of the records in a data set that scale linearly, rather than sublinearly."); id. ¶ 110 ("Under the parties' agreed-upon construction of the term 'sublinear,' a search can scale linearly, rather than sublinearly, even if it 'is designed to determine a very small subset of the reference works in the database.'") (quoting Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 210); Pltf. R. 56.1 Counterstmt. (Dkt. No. 240-61) ¶¶ 109-10 ("Undisputed.")) Nor has Plaintiff attempted to explain why that would necessarily be the case.

[redacted] (Pltf. Sum. J. Opp. (Dkt. No. 240) at 7 (citing Pltf. Ex. 40 (Dkt. No. 240-15))) The stated purpose of this project is to [redacted] (Pltf. Ex. 40 (Dkt. No. 240-15) at 2 (emphasis omitted)) The document proposes [redacted] (Id.) The match system described in this document would use [redacted] (Id. at 3)

Plaintiff highlights the following language in this Google document:

[redacted]

(Pltf. Sum. J. Opp. (Dkt. No. 240) at 7 (quoting Pltf. Ex. 40 (Dkt. No. 240-15) at 9) (emphasis in Pltf. Sum. J. Opp.)) Plaintiff argues, and Defendants do not dispute, that "CPU (central processing unit) and RAM (random access memory) resources are related to the amount of computing power" used by a particular search method. (Id.) The more computing resources that are used, the less time that is required to complete a search.

As an initial matter, the Google document quoted by Plaintiff is marked "draft," and Plaintiff has not proffered evidence demonstrating that the design(s) outlined in the document were ever implemented, and if so, to what extent. (Pltf. Ex. 40 (Dkt. No. 240-15) at 1; see MAG Aerospace Indus., Inc. v. B/E Aerospace, Inc., 816 F.3d 1374, 1379 (Fed. Cir. 2016) ("As to the CAD drawing, there is no evidence that it represented the actual product marketed and sold."))

Moreover, Plaintiff has quoted this document out of context. When the relevant language from this 2010 draft document is considered as a whole, it becomes clear that Google

was considering two design options, [redacted]. The record is silent as to whether either of these options was chosen, or whether Google pursued an entirely different option.

As to scaling, the document states that [redacted] (Pltf. Ex. 40 (Dkt. No. 240-15) at 9) The document's next sentence – omitted by Plaintiff – states that, [redacted] (Id.) By contrast, if the [redacted]." (Id. (emphasis added)) The document thus identifies a tradeoff between (1) [redacted] and (2) [redacted]). (See id.) The document concludes by stating that [redacted] between these two options. (Id.) [redacted] (Id.) [redacted] (Id.) But Plaintiff has not

proffered evidence that either version of Content ID described in the draft document was actually implemented, much less that the [redacted] version was implemented instead of the [redacted] version.

Given these circumstances, the Google document cited by Plaintiff does not show that the LSH version of Content ID is "capable of infringing," see ePlus, Inc. v. Lawson Software, Inc., 700 F.3d 509, 520 (Fed. Cir. 2012), much less actual infringement. Even where there is "no dispute" that an accused device is "technically capable" of infringing, the patentee must present evidence that it is "more likely than not [that] . . . the accused system[] [] perform[s] the [specific claim limitation]." See id. "Unless the claim language only requires the capacity to perform a particular claim element, . . . it is not enough to simply show that a product is capable of infringement; the patent owner must show evidence of specific instances of direct infringement." Fujitsu Ltd. v. Netgear Inc., 620 F.3d 1321, 1329 (Fed. Cir. 2010); see also ACCO Brands, Inc. v. ABA Locks Mfrs. Co., 501 F.3d 1307, 1313 (Fed. Cir. 2007) ("In order to prove direct infringement, a patentee must either point to specific instances of direct infringement or show that the accused device necessarily infringes the patent in suit.").

For the reasons explained above, the CoverCat draft does not constitute evidence of "specific instances of direct infringement," nor does it show that the LSH system "necessarily infringes the patent[s] in suit." Acco Brands, 501 F.3d at 1313.

c. Dr. Baluja's Scientific Papers and Deposition Testimony

In arguing that there are material issues of fact as to whether the LSH version of the Content ID system performs a sublinear search, Plaintiff also cites to a scientific abstract written by two Google employees, Drs. Shumeet Baluja and Michele Covell, entitled "Learning to Hash: Forgiving Hash Functions and Applications," and to Dr. Baluja's deposition testimony.

(Pltf. Sum. J. Opp. (Dkt. No. 240) at 7-8) The abstract – published in 2008 – addresses the problem of "retriev[ing] examples from a database that are similar to a [query] example in a manner that is [] efficient." (Pltf. Ex. 56 (Dkt. No. 240-31) at 4; Baluja Dep. (Dkt. No. 240-4) at 178-81) The paper discusses several then-existing forms of hashing and notes that "LSH [locality-sensitive hashing] and other hash functions are sublinear in the number of elements examined compared to the size of the database." (Pltf. Ex. 56 (Dkt. No. 240-31) at 4)

Dr. Baluja has been employed at Google since 2003 as a staff research scientist. (Baluja Dep. (Dkt. No. 240-4) at 10, 16) He holds a bachelor's degree in computer science and philosophy from the University of Virginia, and a Ph.D from Carnegie Mellon in computer science and robotics. (Id. at 10-11) He held a variety of research and scientific positions at tech companies prior to joining Google. (Id. at 12-16) At Google, Dr. Baluja has held a variety of basic research positions in the areas of wireless communications, image processing, social networks advertising, and video recognition. (Id. at 16-26, 135) Dr. Baluja was part of the Google research team that developed the core matching technology utilized in Content ID. (Id. at 116) Dr. Baluja is not involved in the commercial applications resulting from his research. (Id. at 26 ("One could always hope that your research is used in the real world, but that's not my concern."))

At deposition, Dr. Baluja was first asked about a 2008 paper he and Covell published in the scientific journal Pattern Recognition in May 2008. The paper is entitled "Waveprint: Efficient Wavelet-based Audio Fingerprinting." (Pltf. Ex. 54 (Dkt. No. 240-29)) Baluja testified that the locality sensitive hashing approach in matching technology permits the scaling of the matching system to be sublinear:

> Q Toward the end of the first paragraph, it says, "The system also provides good scaling characteristics. When the database size is increased by 50 percent, we see

that we can have a sublinear computation increase while having no significant impact on recognition." Do you see that?

A Yes, yes.

Q What does that mean?

A So what that means is we will still consider all the elements in our repository without having to examine them in detail.

Q So using this LSH approach allows the scaling of the system to be sublinear in that sense? Is that what you're saying?

A Yes.

(Baluja Dep. (Dkt. No. 240-4) at 138)

Dr. Baluja was then questioned about the 2008 abstract entitled "Learning to Hash: Forgiving Hash Functions and Applications," in which he states that "LSH and other hash functions are sublinear in the number of elements examined compared to the size of the database." (Pltf. Ex. 56 (Dkt. No. 240-31) at 4; Baluja Dep. (Dkt. No. 240-4) at 180-181) Dr. Baluja confirmed that this reference to sublinear is "the same sublinearity that we discussed earlier." (Id. at 181)

Plaintiff argues that Dr. Baluja's references to sublinearity in the abstract and journal article, as well as his deposition testimony, create a material issue of fact as to whether the LSH version of the Content ID system performs a sublinear search. (Pltf. Sum. J. Opp. (Dkt. No. 240) at 7-8)

As an initial matter, while Dr. Baluja was part of the Google research team that developed the core matching technology utilized in Content ID (Baluja Dep. (Dkt. No. 240-4) at 116), he is a scientist who does basic research. He is not an engineer and has no role in the commercial applications resulting from his research. At deposition, he was not asked about – and did not testify regarding – the functioning of the LSH version of Content ID. (See id. at 99 ("But I'm not an engineer. . . . [I]f I wrote a system for Google, it would probably crash entire

Google. So that's why I do research.")) Similarly, the journal article and abstract that he was questioned about at deposition do not address or describe the LSH version of Content ID (see Pltf. Ex. 56 (Dkt. No. 240-31) at 4 (proposing a hashing system that "far surpasses, in terms of both efficiency and accuracy, a state-of-the-art Locality-Sensitive-Hashing-based technique for the same problem and data set")), and say nothing about whether the LSH version of Content ID performed a "search whose execution time scales with a less than linear relationship to the size of the data set to be searched, assuming computing power is held constant." (Am. Jt. Claim Construction Stmt. (Dkt. No. 246) at 2)

For these reasons, Dr. Baluja's references to sublinearity in his scientific papers do not demonstrate that the LSH version of Content ID performs sublinear searches.

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In sum, the evidence cited by Plaintiff does not create a material issue of fact as to whether the LSH version of Content ID performs a sublinear search.[20] Accordingly, Defendants

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[20] Plaintiff's infringement claim fails for another and independent reason. In arguing that the LSH version of Content ID performs a sublinear search, Plaintiff addresses only Stage I of that system. It is undisputed, however, that there are two stages in the LSH version of the Content ID system, and that it is the combination of these two stages that result in a complete search. (See Pltf. Sum. J. Opp. (Dkt. No. 240) at 24-25 ("The search algorithm of the LSH version of the system has two main stages referred to as 'Stage I' and 'Stage II.' . . . Defendants' documents explain the combination of these stages as a complete search. . . .")) And "[u]nder the parties' agreed-upon construction of the term 'sublinear,' a multi-step search scales linearly, rather than sublinearly, if at least one of the steps of the multi-step search scales linearly." (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 107; Pltf. R. 56.1 Counterstmt. (Dkt. No. 240-61) ¶ 107 ("Undisputed.")) Accordingly, in order for this Court to conclude that the LSH version of Content ID performs a sublinear search, there would have to be evidence that at both Stage I and Stage II the system performs a sublinear search. There is no such evidence.

While Plaintiff argues that paragraph 209 of the Mitzenmacher Report "explains that the entire search (involving two stages) is sublinear" (Pltf. Sum. J. Opp. (Dkt. No. 240) at 24), Paragraph 209 merely states that "[t]he approximate nearest neighbor (or neighbor or near neighbor) search of the Content ID LSH Version is sublinear." (Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 209) The

are entitled to summary judgment on Plaintiff's infringement claim to the extent it is premised on the LSH version of Content ID.

2. Siberia Version of Content ID

a. Whether the Siberia Version of Content ID Performs a Sublinear Search at the Index Lookup Stage

The parties dispute whether the Siberia version of Content ID meets the sublinear limitation. Google argues that Dr. Mitzenmacher "admitted in his report and confirmed at his deposition that the Siberia search algorithms scale linearly, rather than sublinearly." (Def. Sum. J. Br. (Dkt. No. 224) at 21) Plaintiff responds that Dr. Mitzenmacher testified that the "'the [Siberia] algorithm [] is sublinear because it has [the] ability to change and adapt'" by adjusting the number of shards and partitions as the data set size grows. (Pltf. Sum. J. Opp. (Dkt. No. 240) at 12-13 (quoting Mitzenmacher Dep. (Dkt. No. 240-9) at 128-29) (emphasis omitted))

In his report, Dr. Mitzenmacher states that he "generally agree[s]" "that if additional references were added to the existing shard/partition structure, the [Index Lookup] portion of the search would scale linearly." (Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 229

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subsequent paragraphs in the Mitzenmacher Report – which are discussed above – address only the Index Lookup portion of Stage I, and the evidence cited in Paragraph 209 does not concern the issue of whether Stage II performs a linear or sublinear search. (See id. (citing Dr. Baluja's deposition and the CoverCat draft document)) Accordingly, to the extent that Dr. Mitzenmacher expresses an opinion in his report that the entire search conducted by the LSH Version of Content ID is sublinear, any such opinion is unsupported and conclusory. See Arthur A. Collins, Inc., 216 F.3d at 1047 ("[A] party may not avoid summary judgment simply by offering an opinion of an expert that states, in effect, that the critical claim limitation is found in the accused device. . . . [T]he affidavit of an expert submitted in opposition to a motion for summary judgment must do more by 'set[ting] forth specific facts showing that there is a genuine issue for trial.'") (quoting Celotex, 477 U.S. at 323, 325). Nor has Plaintiff articulated any theory for why, even assuming Stage I of the LSH Version performs a sublinear search, Stage II must likewise be found to perform a sublinear search. Because Plaintiff has offered no evidence that the entire search performed by the LSH version of Content ID is sublinear, Defendants are entitled to summary judgment on Plaintiff's infringement claim to the extent it is premised on the LSH version of Content ID.

(emphasis in original)) Dr. Mitzenmacher further acknowledges that "doubling the size of a reference index by simply adding references to the existing shards . . . could result in the [Index Lookup] portion of the search taking approximately twice as long." (Id. ¶ 230) Despite these concessions, Plaintiff contends that "the search algorithm Content ID Siberia Version was designed to be used" in a way that makes the entire system sublinear, and that the number of partitions per shard is a "turnable knob" that makes "the search algorithm Content ID Siberia Version" sublinear. (Pltf. Sum. J. Opp. (Dkt. No. 240) at 14-16; see also Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 230 ("[D]oubling the size of a reference index by simply adding those references to the existing [structure] is not what would be done."); id. ¶¶ 238-39 ("[I]ncreasing the [redacted] as the size of the data set [] increases would result in sublinear scaling."))

Plaintiff also points to an [redacted]. (See Pltf. Supp. Sum. J. Opp. (Dkt. No. 274) at 3-5) According to Plaintiff, this development "confirms that the Siberia version of Google's Content ID system uses a sublinear search." (Id. at 3 (capitalization altered))

Plaintiff is mistaken. Assuming arguendo that reducing the [redacted] also reduced the time or computing resources needed to perform a search,[21] Plaintiff does not dispute that if additional references were added to the index as it existed as of

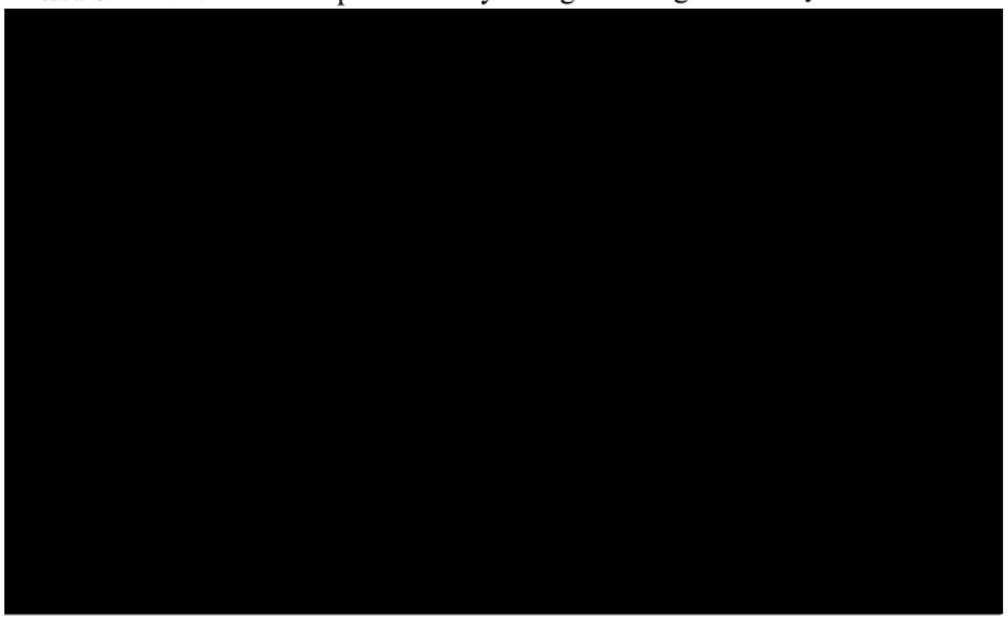
[21] There is no evidence that Google [redacted]. Accordingly, standing alone, [redacted] does not demonstrate that the Siberia Version of Content ID performs a sublinear search.

[redacted], search execution time would still scale linearly. (Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 229)

The '237 Patent teaches that the invention must perform a "sublinear . . . search." ('237 Patent (Dkt. No. 148-5) col. 28) The specification states that "a linear search of all N entries" in a database is "computationally expensive," and lists exemplary sublinear search algorithms and data structures with sublinear search times, including binary search, kd-trees, vantage point trees, and middle vantage point forest. (Id. col. 21) The specification does not suggest, however, that a linear search algorithm can be adapted to the problem using parameters – "turnable knobs" – that can be periodically adjusted to improve the search's consumption of resources. Indeed, Plaintiff conflates the Siberia system as a whole – which conceptually encompasses multiple steps that map onto the '237 Patent, including indexing and taking an action after finding a match – with the required search step. (Pltf. Sum. J. Opp. (Dkt. No. 240) at 16 (referring to the entirety of the Siberia Version of Content ID as "the search algorithm Content ID Siberia Version"))

In sum, the undisputed evidence is that the Siberia version of Content ID uses search algorithms that scale linearly as the size of the database increases. The evidence also shows that Google can periodically adjust certain parameters to lower the resource costs imposed by the increased size of the database. But that fact does not transform a linear search algorithm or database architecture into a sublinear one.

In arguing to the contrary, Plaintiff places great weight on the following graph and similar documents produced by Google during discovery:



(Id. at 14; Pltf. Ex. 67 (Dkt. No. 240-42) at 6) Plaintiff asserts that the graph depicts [redacted] (Pltf. Sum. J. Opp. (Dkt. No. 240) at 14) The two solid lines represent [redacted]. According to Dr. Mitzenmacher, the currently implemented version [redacted] algorithm. But "[r]egardless" of which algorithm is used, the graph demonstrates that "the search scales sublinearly." (Mitzenmacher Rpt. (Dkt. No. 226-6) ¶¶ 157-58)

The graph cited by Plaintiff plainly contemplates that as the dataset grows, so does the number of "machines." As discussed above, in the Siberia system, data is stored in shards on individual "machines," or computers. (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 39; Pasula Dep. (Dkt. No. 240-5) at 39, 77; Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 153 [redacted]

[redacted] The graph does not suggest that any search performed by the Siberia system is sublinear "assuming computing power is held constant," because what it shows is an increase in the total amount of computing resources as the size of the dataset increases. (Am. Jt. Claim Construction Chart (Dkt. No. 146) at 2) Plaintiff does not address the fact that – in the graph it cites – computing power is not "held constant," nor does Plaintiff attempt to explain why the Court should ignore this fact. (Pltf. Sum. J. Opp. (Dkt. No. 240) at 14) Nor does the mere use of the term "sublinear" on the graph demonstrate that the claim limitation is meant. Finally, because Dr. Mitzenmacher, Plaintiff's expert witness, concedes that the index-lookup algorithm scales linearly, the graph and other documents containing the word "sublinear" are not sufficient to create a material issue of fact.

b. Whether the Siberia Version Performs the Required Nearest Neighbor Search

Defendants argue that even that assuming the Index Lookup portion of the search is sublinear, Plaintiff has not shown that "the allegedly sublinear Siberia Index Lookup uses media work extracted features to perform an 'approximate nearest neighbor search of reference extracted features.'" (Def. Sum. J. Br. (Dkt. No. 224) at 30-31) According to Defendants, "Dr. Mitzenmacher admits that the Index Lookup does not meet those limitations and, instead, [impermissibly] tries to mix and match different aspects of the Siberia system to show infringement." (Id. (emphasis omitted))

The parties agree that the Siberia version of Content ID "has three main stages": Index Lookup, Sparse, and Verifier. (See Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 43; Pltf. R. 56.1 Counterstmt. (Dkt. No. 240-61) ¶ 43) Neither side has argued that any one stage constitutes a single "search" for purposes of proving infringement. And Plaintiff does not argue that an

"approximate nearest neighbor search" is performed at the Index Lookup stage.[22] (Pltf. Sum. J. Opp. (Dkt. No. 240) at 17-23) Similarly, Defendants do not contend that an "approximate nearest neighbor search" is performed at the Sparse and Verifier stages, whether separately or together. (See Def. Sum. J. Reply (Dkt. No. 227))

Moreover, and as discussed above, "[u]nder the parties' agreed-upon construction of the term 'sublinear,' a multi-step search scales linearly, rather than sublinearly, if at least one of the steps of the multi-step search scales linearly." (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 107; Pltf. R. 56.1 Counterstmt. (Dkt. No. 240-61) ¶ 107; Mitzenmacher Dep. (Dkt. No. 240-9) at 105-09 (noting that a function with a linear term and a logarithmic term scales linearly))

According to Plaintiff, the Mitzenmacher Report "explains that the entire, three stage, search algorithm of" the Siberia Version of Content ID "is a sublinear search algorithm." (Pltf. Sum. J. Opp. (Dkt. No. 240) at 17-18)

The Mitzenmacher Report addresses the alleged sublinearity of the Sparse and Verifier stages as follows:

> The time that the overall search takes (e.g., the combination of [Index Lookup], Sparse, and Verifier steps) would increase by less than a factor of two if the number of hashed embeddings in the reference index were doubled. This is because the amount the latter two steps take would remain roughly constant since the number of index hits [coming] out of the [Index Lookup] step would remain the same. In other words, the data set size and the search time of the Content ID Version do not have a one to one relationship.

(Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 230 n.197) The remainder of Dr. Mitzenmacher's report is directed to the Index Lookup stage. (Id. ¶¶ 229-46)

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[22] Because the Index Lookup stage [redacted] (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶ 52) – it does not involve the use of a "defined threshold" as required under the parties agreed-upon construction of "nearest neighbor search." (Am. Jt. Claim Construction Chart (Dkt. No. 146) at 2)

As an initial matter – because Dr. Mitzenmacher's remarks concerning the Sparse and Verifier stages are not supported by any citations to evidence – he has not "set forth the factual foundation for his infringement opinion in sufficient detail for the court to be certain that features of the accused product would support a finding of infringement." Intell. Sci. & Tech., Inc., 589 F.3d at 1183.

Moreover, other portions of Dr. Mitzenmacher's opinion contradict his assertion that the amount of time the Sparse and Verifier steps would take "would remain roughly constant." (Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 230 n.197) As discussed above, it is undisputed that for the Video Index, the Index Lookup step [redacted] (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶¶ 48-49; Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 223)) The system then [redacted] (Def. R. 56.1 Stmt. (Dkt. No. 225) ¶¶ 51-52) Accordingly, for a search of the Video Index, the Index Lookup step outputs [redacted] and passes those on to the Sparse and Verifier steps. (Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 223; see Def. R. 56.1 Stmt. (Dkt. No. 225) ¶¶ 59, 60) It is correct that in the example given above – [redacted]. Thus, the time necessary to execute the Sparse and Verifier steps would be "constant" such that if the Index Lookup portion is sublinear, the entire Siberia search would also be sublinear. (See Pltf. Sum. J. Opp. (Dkt. No. 240) at 18-19 (explaining the "basic mathematical principle" that "$y = \sqrt{x} + 1 + 1$ is still a sublinear function"

where "y" is the time it takes to execute a search, "x" is the number of references in the data set, "√x" is the time it takes to complete the Index Lookup step for a given search, and "1 + 1" represents the time taken to complete the Sparse and Verifier steps))

Dr. Mitzenmacher's premise for arguing in his Report that the Index Lookup step is sublinear, however, is that "doubling the size of the reference index by simply adding those references to the existing shards[] is not what would be done. . . . [A]s the size of the reference index increases, so would the number of shards and partitions." (Mitzenmacher Rpt. (Dkt. No. 226-6) ¶ 230) If the number of shards in the index increased, so would the number of references output by the Index Lookup step – [redacted] – and examined by the Sparse and Verifier steps. Moreover, to the extent that the number of shards and partitions examined at various stages of Siberia's search are "turnable knob[s]" (Pltf. Sum. J. Opp. (Dkt. No. 240) at 15) the number *k* of embeddings per shard output by the Index Lookup step is also presumably "turnable." The Mitzenmacher Report's assertion that the time necessary to complete the Sparse and Verifier portions of the search is a constant in thus not only unsupported, but internally inconsistent with the argument that as the size of the data set increases so would the number of partitions and shards.

In sum, even if the Court concluded that the evidence demonstrated that the Index Lookup portion of the Siberia search is sublinear, that evidence itself would preclude an inference that the Sparse and Verifier portions of the search are "constants" for purposes of sublinearity.

The unsupported, conclusory, and internally inconsistent assertion in footnote 197 of the Mitzenmacher Report is insufficient to create a material issue of fact as to the alleged sublinearity of the three-stage Siberia search. See Power Integrations, Inc. v. ON Semiconductor

Corp., 396 F. Supp. 3d 851, 886 (N.D. Cal. 2019) (rejecting expert witness's "conclusory" and "internally inconsistent statements" at summary judgment).

CONCLUSION

For the reasons stated above, the asserted claims of the '988 and '464 Patents are invalid as indefinite, and the remaining disputed terms are construed as set forth above. Defendants' motion for summary judgment is granted as to Plaintiff's claim for infringement of the '237 Patent. The Court's rulings with respect to indefiniteness and Defendants' motion for summary judgment dispose of all the asserted claims in this case. Plaintiff's cross-motion for summary judgement is denied.[23] The Clerk of Court is directed to terminate the motions (Dkt. Nos. 223, 233), to enter judgment for Defendants, and to close this case.

Dated: New York, New York
April 24, 2024

SO ORDERED.

Paul G. Gardephe
United States District Judge

[23] As noted above, Plaintiff has appealed Magistrate Judge Netburn's October 14, 2022 order striking portions of Plaintiff's Supplemental Expert Report concerning a "late-proposed non-infringing alternative that Google was allowed to introduce through [] supplemental discovery." According to Plaintiff, its Supplemental Expert Report demonstrates that Google's "non-infringing alternative . . . is not viable." (See Oct. 14, 2022 Discovery Order (Dkt. No. 283); Pltf. Discovery Appeal Br. (Dkt. No. 235) at 4) Plaintiff states, however, that "neither the Magistrate's Order, nor [Plaintiff's] Objection, bear on the parties' [] motions for summary judgment." (Pltf. Discovery Appeal Br. (Dkt. No. 235) at 4) Given this Court's decision granting Defendants' motion for summary judgment, Plaintiff's appeal of the magistrate judge's discovery order is denied as moot.